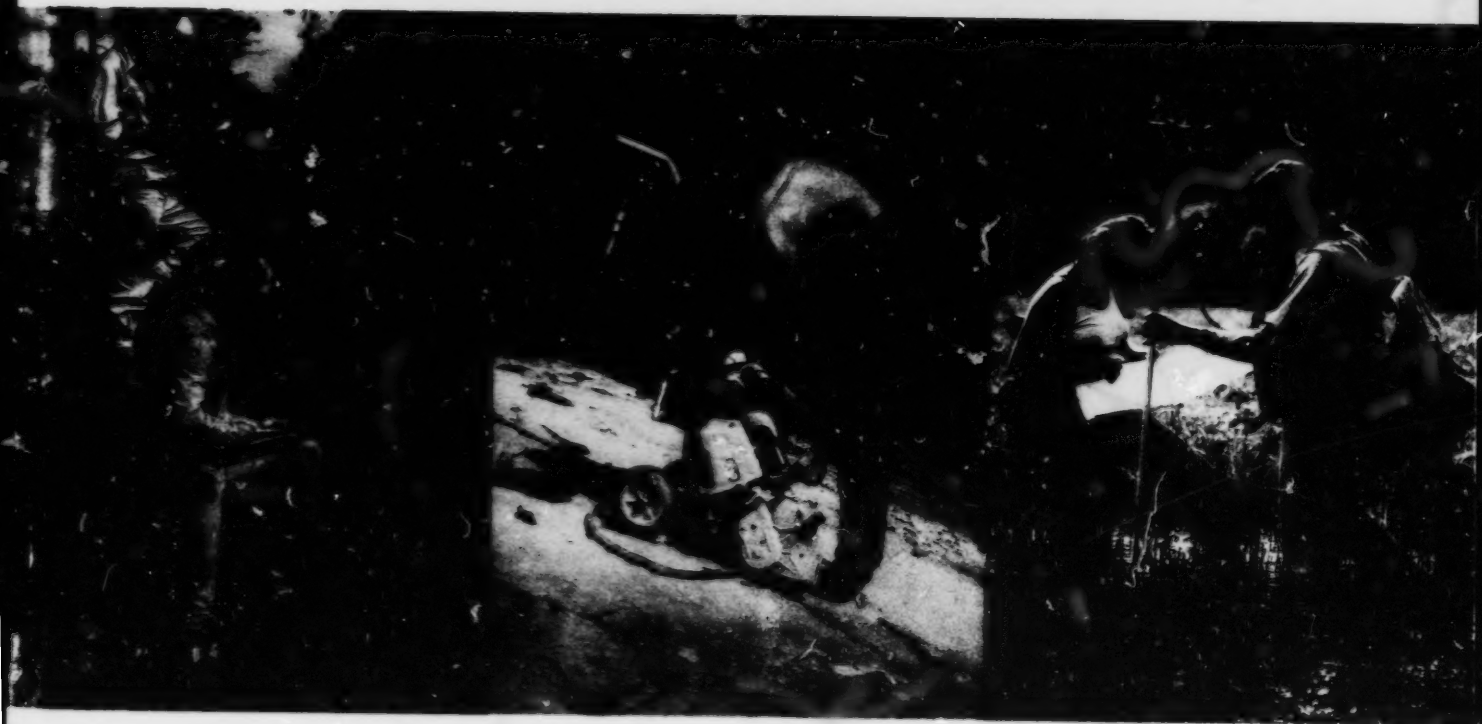


MINERALS

ECONOMIC & REGIONAL DEVELOPMENT AGREEMENT

Sector A Geoscientific Activities Progress Report 1986-87



Canada

Manitoba



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CANADA - MANITOBA

MINERAL DEVELOPMENT AGREEMENT

1984 - 89

SECTOR 'A' GEOSCIENTIFIC ACTIVITIES

PROGRESS REPORT 1986-87

**Manitoba
Energy and Mines
Geological Services
Open File Report OF87-3**



Frontispiece: Test-auguring of potential silica deposits east of Winnipeg.

FOREWORD

This progress report chronicles the achievements of the Provincial and Federal Geological Surveys in the third year of cooperative programming mounted under Sector A of the Canada-Manitoba Mineral Development Agreement, a subsidiary agreement to the Economic and Regional Development Agreement (ERDA).

The report summarizes MDA-related geological investigations in Manitoba during the 12 month period ending March 31, 1987, and describes the rationale behind the work, the location and focus of activities, the agencies and individuals involved, and output that has been generated. As such the report constitutes an administratively oriented supplement to technical publications which are the principal product of the Surveys' work.

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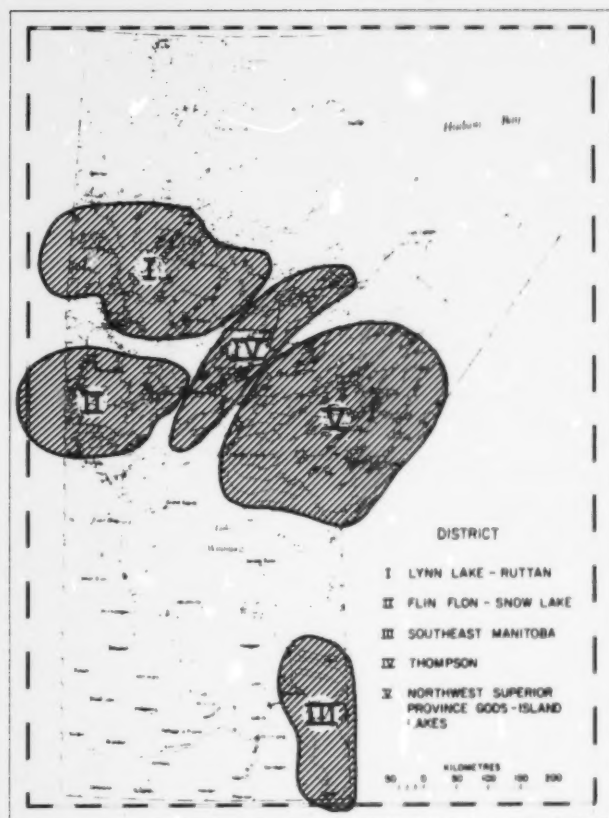


Figure 1: Canada-Manitoba Mineral Development Agreement: Focus of 'Sector A' Geoscientific Activities.

Table 1

CANADA-MANITOBA MINERAL DEVELOPMENT AGREEMENT
SCHEDULE "B"
Summary of Costs 1984-89
(\$000,000's)

Sector/Program/Project	Federal Share	Provincial Share	Total Costs 5-Years
SECTOR A GEOSCIENTIFIC ACTIVITIES			
Program 1 Precambrian Geological Investigations		1.1	1.1
— Detailed geological mapping, drilling	0.9		0.9
— Regional geological models, drilling			
Program 2 Minerals Investigations		2.05	2.05
— Detailed metallic and industrial minerals studies, applied research	1.25		1.25
— Mineral deposit models			
Program 3 Geophysical Surveys	2.45		2.45
Program 4 Geochemical Surveys and Glacial Prospecting			
— Regional geochemical surveys	2.05		2.05
— Quaternary geology surveys	0.85		0.85
— Detailed environmental geochemistry and glacial prospecting		0.25	0.25
Program 5 Geological Compilation			
— Various compilation and information outputs		1.8	1.8
— Quaternary geology atlas, data systems	0.5		0.5
Subtotal Sector A	8.0	5.0	13.0
SECTOR B RESEARCH AND TECHNOLOGY			
Program 1 Mining Technology		75	75
2 Mine Safety and Productivity			
Project 2.1 Ground Control	1.32		1.32
2.2 Warning Systems	295		295
2.3 Exposure Index		295	295
Program 3 Processing Technology			
Project 3.1 SO ₂ Reduction	2 180		2 180
3.2 Mining Research	470		470
3.3 Tailings Research		1 10	1 10
3.4 Industrial Minerals	4	62	1 02
Subtotal Sector B	4 665	2 765	7 43
SECTOR C DEVELOPMENT STUDIES	885	885	1 77
SECTOR D PUBLIC INFORMATION, etc.	1.25	1.25	2.5
TOTAL	14.80	9.9	24.70

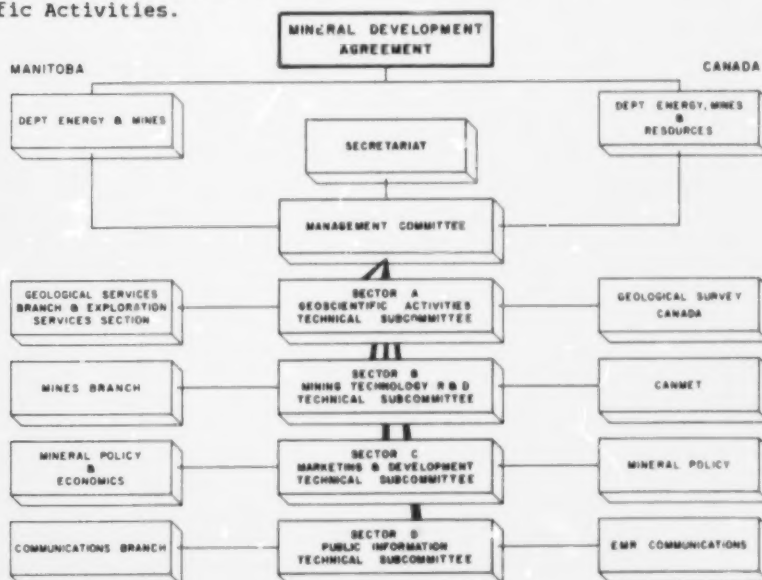


Figure 2: Federal-Provincial liaison network and government agencies contributing to programming under the Canada-Manitoba Mineral Development Agreement (1984-89).

**I. CANADA-MANITOBA
MINERAL DEVELOPMENT AGREEMENT**

1984-89

BACKGROUND

The Canada-Manitoba Mineral Development Agreement is an important component in the Provincial and Federal governments' plan for stable and steady economic growth of the mineral industry in Manitoba. It also encompasses an all-embracing vision of Manitoba's future, a future in which the communities relying on the mineral industry will continue to grow and prosper.

On November 25, 1983 the Federal and Provincial cabinets approved both the umbrella Economic and Regional Development Agreement (ERDA) and the subsidiary Canada-Manitoba Mineral Development Agreement (MDA).

Under the five-year MDA (1984-89) the Federal and Provincial governments will contribute \$14.8 million and \$9.9 million, respectively for a total funding of \$24.7 million.

The goals of the MDA are:

- (a) to increase mineral exploration and the development of mineral resources in Manitoba, consistent with the broader joint planning underway through ERDA;
- (b) to assist in the more effective assessment and utilization of the province's mineral resources; and
- (c) to establish a framework for programs which will strengthen and diversify the mineral resource base of the provincial economy.

The MDA is designed to gather data, analyze, synthesize and disseminate information on the geology of Manitoba (with a special emphasis planned for the Lynn Lake/Ruttan and Flin Flon/Snow Lake Districts) (Fig. 1). It is also intended to coordinate research on mineral processing, metallurgical technology and mining methods, and to conduct marketing and other economic studies.

Work under the Agreement is grouped into four sectors (Table 1): A - Geoscientific studies, B - Mining and mineral technology R and D; C - Development and Marketing studies; and D - Public information, evaluation and administration.

Sector A - Geoscientific activities (the subject of this Progress Report), are implemented by the Geological Survey of Canada (GSC) and the Manitoba Geological Services Branch (MGSB) together with research contributions contracted from universities.

Programs are organized into five categories: 1 - Precambrian Geological Investigations, 2 - Mineral Investigations, 3 - Geophysical Surveys, 4 - Geochemical Surveys, and 5 - Geological Compilations.

Workplans are developed each year by technical subcommittees (Fig. 2) with industry input encouraged through a Mineral Exploration Liaison Committee (MELC) as well as through ongoing dialogue between government and industry geologists.

The joint Federal/Provincial Workplan for 1986-87 was approved by the Management Committee to the Agreement at its meeting in Ottawa, on February 27, 1986, and copies distributed to MELC representatives in March of that year.

TABLE 2. Sector 'A' 1986/87 Expenditures by program
Geological Survey of Canada (GSC) and
Manitoba Geological Services Branch (MGSB)

	PROGRAM	GSC* (\$000)	MGSB** (\$000)
1	Precambrian Mapping	504.4	289.8
2	Minerals Investigations	287.0	468.9
3	Geophysical Surveys	606.1	-
4	Geochemical Surveys/ Basal Till	771.0	67.7
5	Compilations	16.0	155.4
6	Overhead including Capital	<u>95.0</u>	<u>19.2</u>
	TOTAL	<u>2279.5</u>	<u>1000.0</u>

* GSC projections December 31, 1986 (original budget allocation \$2255.5).

** MGSB projections February 28, 1987 (original budget allocation \$1009.1).

II. SECTOR A
GEOSCIENTIFIC ACTIVITIES
PROGRESS REPORT

REVIEW OF ACTIVITIES 1986/87:

On February 27, 1986, the Management Committee approved the MDA Workplan for 1986-87 including Sector A Geoscientific activities encompassing 55 Provincial and 22 Federal projects with operational budgets of \$1,000,000 and \$2,250,000, respectively.

Briefing sessions were given in each of the northern mining districts, and a complete review of all MDA activities was presented to the Winnipeg section of the CIM in April prior to the 1986 field season.

Government-industry field tours and demonstrations were held in the Thompson and Flin Flon-Snow Lake areas; however, a demonstration planned for the Cross Lake region was postponed as a result of high water levels on the Nelson River.

Survey crews were deployed in May, the Provincial operations being supported by 46 university students who were employed and trained for a total of 2494 days.

In this the third year of the Agreement, although Provincial MDA funding was reduced to 66% of that available in 1985-86 (Table 2), projects continued in all districts of concern with a special focus in the Lynn Lake-Ruttan and Flin Flon-Snow Lake mineral belts. The fall-off in Provincial expenditures was more than compensated by a 50% increase in GSC expenditures to \$2.25 million dollars (Fig. 3).

Virtually all program commitments made for fiscal year 1986-87 were attained by March 31, 1987, although data processing linked to some geophysical contracts lapsed over year-end and the Province's consolidation of core facilities in Winnipeg continues on hold. For several projects the initial field objectives set under the MDA were attained, and the stage set for data compilation, analysis and final report production.

A Progress Report covering all aspects of Sector A programming during fiscal 1985-86 was released in August 1986. Other Open File reports were released throughout the year together with numerous brochures on various aspects of Agreement programming.

The reduced Provincial funding levels impacted adversely on the Province's ability to sponsor support studies and accordingly applied geoscience research (AGR) efforts were constrained to six projects, 5 being with the University of Manitoba. The Geological Survey of Canada sponsored 12 AGR projects, six through the University of Manitoba and six to universities and agencies in other provinces.



Figure 3. Eldon Lake drill core storage facilities (MDA Sector B core retrieval program; see project reports 1.7.1 and 1.7.2).

MGSB staff also provided input to other MDA Sectoral activities including drilling of tailings at Sherridon and Flin Flon, dimension stone site-selection in southeast Manitoba, acquisition of kaolin samples from Black Island for beneficiation studies by CANMET, and editorial and technical input to brochures on industrial minerals and basal till studies, educational programs, and a contracted evaluation of rubidium-enriched feldspar from Bernic Lake. Major contributions were also made to the development of a Geological Highway Map of Manitoba, funded by Canada under Sector D with coordination by the Winnipeg Section of the Geological Association of Canada.

The Mineral Exploration Liaison Committee was expanded to include representatives from all three major northern mining districts, Winnipeg-based exploration companies, the Winnipeg section of the Prospectors and Developers Association, and the Manitoba-Saskatchewan Prospectors Association.

Industry representation is currently as follows:

Lynn Lake-Ruttan District	Jim Chornoby
Flin Flon-Snow Lake District	Bill Burbidge
Thompson District	Merv Toderian
Winnipeg-based Companies	Tony Pryslak
PDA	Bruce Dunlop
Man/Sask. PDA	Mark Kreczmer

The Committee met November 19, 1986 to review the previous summer's field work and to discuss the outline of programs to be delivered in 1987. Several of the industry recommendations were subsequently incorporated into the Workplan for 1987-88.

The results of the 1986-87 field program were reported at the annual Meeting with Industry in Winnipeg on November 20 and 21 (267 registrants). A Report of Field Activities (234 p.), 12 preliminary maps, two compilation maps of the Lynn Lake District a bibliography of Manitoba geology, and several other open file reports were also released at the meeting, along with talks and displays by the Provincial and Federal geologists and staff from the Department of Geological Sciences, University of Manitoba.

Feedback to a questionnaire circulated before, and at, the meeting strongly supported the current level and focus of MDA programming, although a few responses called for more prompt and frequent release of information, and extension of the present mandate to support small non-government projects, and consideration for a prospectors' assistance program. Some responses (less than 5%) were negatively disposed to gradiometer surveys, regional lake sediment surveys and basal till investigations, or suggested cutbacks to the present levels of these programs.

In terms of new programming, strong support was received in favour of MDA-sponsored deep penetrating INPUT surveys, integrated computer accessible data bases and a deposit extension evaluation program (DEEP). Most respondents were not in favour of regional offices.

For the balance of the year Provincial and Federal staff engaged in compilation and analysis of materials and data stemming from the previous field seasons, as well as report production and talks given at various technical seminars, in Manitoba and across Canada.

MDA displays and talks were also featured at the Geological Survey of Canada Forum in Ottawa (January 20 - 21, 1987, 840 registrants) and GSC progress reports in Current Research GSC Papers 87-1A and 1B.

From September 1986 to March 1987 MGSB geological staff responded to over four hundred enquiries on minerals-related topics, in addition to other exchanges at the annual meeting in Winnipeg and enquiries (250) received at the Provincial display booth at the Annual Convention of Prospectors and Developers Association in Toronto (3600 attendees).

Enquiries from the private sector focussed primarily on gold and platinum with an equivalent level of demand for information on industrial minerals, including silica, high-calcium limestone, gypsum, kaolin, building and dimension stone, peat and dolomite.

Specific discussions between industry, MGSB and GSC geologists were subsequently followed up by new private sector ground acquisition in the Seal River, Tow Lake, Kisseynew Lake, Twin Lake, Elbow Lake, Gem Lake, Cross Lake, Pipestone Lake, Utik Lake, and Nokomis Lake areas. A drilling program was initiated near Bissett, and a major new gold exploration program mounted in the Great Island area, again as direct follow-up to MDA informational outputs.

Approximately 14 450 hectares were staked in NTS areas 63K, N and O, and 3020 hectares in NTS 64B within three months of the release of regional lake sediment data in GSC Open Files 1212, 1287 and 1288.

GSC talks covering the platinum group element potential of Manitoba were presented on 13 occasions, in various parts of Canada and in Great Britain. In the Fox River area follow-up has led to major exploration programs by BP Selco and International Platinum Corporation entailing diamond drilling, ground geophysics and airborne geophysical surveys.

Gradiometer surveys in the Lynn Lake region, coupled with ground data have led to significant new insights regarding the controls on gold mineralization in this district, and resulted in private sector follow-up investigations of the Agassiz Metaltect, and in the Cartwright Lake area. Basal till studies in the Lynn Lake and Ruttan area have been used extensively by industry and the methodology has subsequently been tried out by three companies.

At Red Sucker Lake studies of the rare-element enriched lithium, cesium and tantalum-bearing pegmatites have identified a geochemical halo and a degree of fractionation that compares favourably with that of the Tanco mine at Bernic Lake.

MGSB staff also collaborated in other research projects feeding into the general MDA generated data base. These included U-Pb geochronology (University of Kansas); fluid inclusion studies, geothermobarometry of the Pikwitonei region; petrographic investigations of the Namew Lake deposit (University of Regina) and ongoing cooperative studies of the anorthosites in the Pikwitonei region.

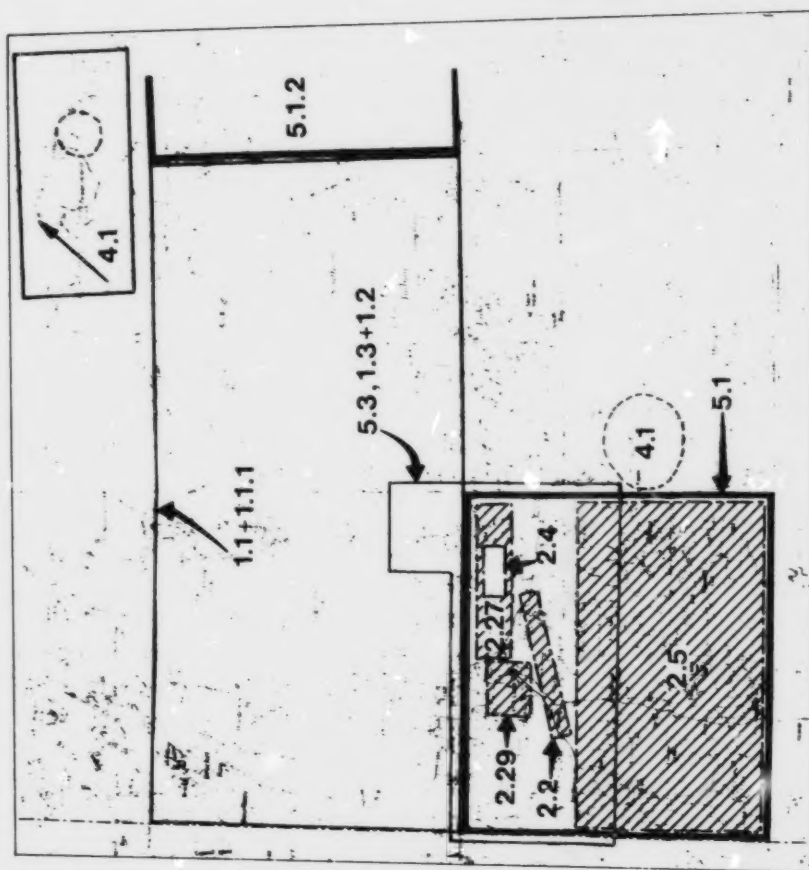
Input was also provided by Provincial and Federal surveys to an Interim Evaluation of the Agreement by Price Waterhouse, initiated by the Department of Supply and Services in December 1986.

MDA-generated information was used extensively as background to a University of Manitoba (Lithoprobe) Workshop on the "Trans-Hudson Orogen" convened in April 1986, and a subsequent Symposium on the "Orogen" scheduled for the GAC/MAC annual meeting in Saskatoon, May 1987.

MGSB staff will contribute seven papers to the symposium and a parallel symposium entitled "Gold in Central Canada", whereas the GSC will contribute nine papers on various aspects of Manitoba geology.

A GAC-sponsored field tour of the Flin Flon-Snow Lake region is to be led by MGSB and GSC staff who have also authored an MDA-based Field Guide for the region.

A full listing of all geoscientific technical publications and other output generated during fiscal 1986-87 is presented in the section following the individual project descriptions.



GEOLOGICAL SURVEY OF CANADA

- PALEOZOIC
- PROTEROZOIC (CHURCHILL)
- GRANTOID TERRAIN
- VOLCANO-SEDIMENTARY TERRAIN
- ARCANEAN (SUPERIOR)
- GRANTOID TERRAIN
- VOLCANO-SEDIMENTARY TERRAIN
- C.2.1.3 Agassiz Remote Sensing
Base: Winnipeg/Lynn Lake
Officer: U of M
- C.4.1.2 Glacial Prospecting
Officer: C. Kaszycki
Base: Sherridon
- C.4.1.4 Quaternary Geochemistry
Officer: C. Kaszycki
Base: Sherridon
- C.1.1.2 Metamorphism - Laurie Lt.
Officer: S. Jackson (Queens)
Base: Laurie Lake

MANITOBA GEOLOGICAL SERVICES BRANCH

- 1.1 Geological mapping brochet-Big Sand Lake
- 1.1.1 U-Pb geochronology SIL-Chipewyan districts
- 1.2 Uranium/Lead isotope investigations
- 1.3 Rubidium-strontium investigations
- 2.2 Gold deposits, Johnson Shear
- 2.4 Geochemistry, biogeochemistry and stratigraphy of the Agassiz Metatolact
- 2.5 Industrial Minerals evaluation
- 2.27 Remote Sensing Computer Evaluation (Federally Funded)
- 2.29 Mineral Deposit Geology, Lynn Lake area
- 4.1 Basal Till investigation, Rutan
- 5.1 Synoptic geological compilation map 64C
- 5.1.2 Synoptic geological compilation map 64H, 54g
- 5.3 Lynn Lake reports and maps

Figure 4: Location of Sector A projects (1986) - DISTRICT I: LYNN LAKE - RUTAN

III. PROJECT REPORTS

DISTRICT I: LYNN LAKE-RUTTAN (including northern Churchill Province)

Summary and Project Listing:

Documentation of mineral deposits in the Lynn Lake area was completed as a first step to creating a mineral deposit inventory for the district. The results will be compiled into 1:50 000 synoptic maps identifying, on a geological base, the deposit type, host rock to mineralization, ore type by weight and volume, and other relevant parameters of the deposits.

Detailed mapping and geochemical sampling at Sheila, Ralph, Spider, Farley, and Motriuk Lakes compared these sections with those of the MacLellan gold mine, and extended the Agassiz Metallotect at least 5 km southwest of Lynn Lake to Margaret Lake. Other settings of gold mineralization between Franklin and Wasekwan Lakes were also investigated, as was the relationship between stratigraphy and base-metal mineralization in the Lynn Lake Rhyolite complex, and the West Anomaly near Ruttan.

Gold mineralization in the Franklin Lake - Wasekwan Lake area appears to be associated with second order dilatant structures and pervasive silicification and chloritization. First order dilatant structures probably acted as channelways for metamorphic fluids and second order dilatant structures provided traps for deposition of gold, sulphides and gangue minerals.

1:50 000 synoptic mineral deposit maps are being prepared and data for the mineral deposit inventory are being collated.

Vegetation studies at the MacLellan Mine and Spider, Farley, and Dot Lakes (as well as the Ferguson Mine at Herblet Lake) encountered much lower levels of trace gold in alder twigs than has been recorded from control studies in Saskatchewan. It was concluded that the gold contents of ash from alder twigs may be substantially affected by the drainage pattern of the sampling area and most importantly the nature of the overburden, including thickness of substrate and organic and clay content. Regional differences in the gold content of alder twigs between Saskatchewan and Manitoba are considered to be related to the occurrence of Manitoba Survey sites within the depositional basin of glacial Lake Agassiz.

Basal till studies initiated in 1985, and subsequently adopted by exploration companies active in northern Manitoba, encountered anomalous arsenic and gold values in the Ruttan region in till deposited on the lee side of large outcrops. Several factors indicated a principal source associated with the Vol Fault.

Till sampling east of Great Island, Seal River, confirmed earlier reported high arsenic values, some of which were significantly well above regional background values. Repeat analyses for gold also yielded anomalously high values. These results, together with previously identified lake sediment geochemical anomalies and recent accounts of extensive arsenopyrite traced to bedrock northwest of Great Island, collectively indicate a hitherto

unrecognized metallogenic signature and high gold potential for the greenstones of this region.

Three plutonic units from the Southern Indian Domain have also been dated using U/Pb zircon isotopes.

U-Pb zircon ages from porphyritic granite and monzocharnockite in the Chipewyan Batholith are coeval, agree with those from the Saskatchewan extensions of the pluton, and appear to indicate emplacement of magma at 1855 Ma into slightly older (1875-1880 Ma) crustal rocks. Although intense deformation appears to have waned by 1832 Ma, the largely post-tectonic dyke on Reindeer Lake giving this age shows evidence of subsequent deformation and recrystallization.

GSC

Total field and vertical gradient magnetic maps at a scale of 1:50 000 were released for the Laurie Lake-Lynn Lake and Issett Lake-Pemichigamau Lake areas on April 29, 1986.

Multi-spectral remote sensing data have now been acquired for the Lynn Lake region, and will be used to search for metal-induced stress in vegetation associated with blind mineralization along the entire length of the Agassiz Metallotect.

Detailed geological mapping continued near Laurie Lake and the Fox Mine as well as investigations into alteration zones associated with volcanogenic massive sulphide deposits elsewhere in the Lynn Lake-Ruttan region.

MANITOBA GEOLOGICAL SERVICES BRANCH

PROJECT 1.1:

Geological mapping, Big Sand-Brochet area

INVESTIGATOR:

D.C.P.Schledewitz

OBJECTIVES:

To provide an updated and more detailed map and comprehensive report on NTS areas 64F and 64G to assist mineral exploration and evaluation of regional geochemical data.

PROGRESS:

Map production is complete; a report is being prepared, and will be completed in 1988.

PRODUCTS:

Two compilation maps with marginal notes, 64F and 64G, were prepared for the Branch's Bedrock Compilation Series. A regional geological summary describing the distribution and petrology of granitic rocks was presented at a Workshop, in April 1986, to develop a proposal for a lithoprobe transect across the Trans-Hudson Orogen.

FOLLOW-UP AND IMPLICATIONS:

A zone of mineralization outlined by mapping in the Le Clair Lake area yielded encouraging results during a subsequent basal till sampling program.

PROJECT 1.1.1:**U-Pb zircon geochronology - Lynn Lake region (R.V.S.)****INVESTIGATORS:**

R. Van Schmus (University of Kansas)

D.C.P. Schledewitz

OBJECTIVES:

To provide precise age determinations of major plutonic rock units in the Lynn Lake, Southern Indian and Chipewyan districts.

PROGRESS:

Forty-two (42) fractions of nine samples collected in 1984 and 1985 from the Chipewyan batholith in the Big Sand Lake area have been analyzed and eight ages were determined. In addition preliminary ages of three plutonic units of the Southern Indian domain were determined.

PRODUCTS:

Isotope ages were used in the compilation maps 64F and 64G, to be printed in 1988. The significance of the ages was discussed in a contribution to MGSB Report of Field Activities 1986 (GS-45).

FOLLOW-UP AND IMPLICATIONS:

- Analyses of remaining samples.
- Current results indicate that the Chipewyan batholith has an age of 1855 ± 10 Ma similar to that of the Wathaman Batholith and that the pluton intruded crustal rocks 1875-1880 Ma old. A post-orogenic dyke yielded a 1832 Ma U-Pb age.

PROJECT 1.2: Uranium-lead isotope investigations, Southern Churchill Province

INVESTIGATORS: D.A. Baldwin, A.H. Bailes, E.C. Syme, H.V. Zwanzig (Geological Services Branch);
T.M. Gordon, P.A. Hunt, R.D. Stevens (Geological Survey of Canada)

OBJECTIVES:

To determine, by U-Pb isotope analysis, the ages of selected rock units in the Lynn Lake and Flin Flon regions. Accurate ages of volcanic and intrusive rock units comprise an essential part of the geological data base, and indirectly date the formation of enclosed base and precious metal deposits.

PROGRESS:

Several samples from the Flin Flon-Snow Lake area were analyzed at the GSC geochronology laboratory (see Project C.1.1.3).

PRODUCTS:

An abstract summarizing the results of investigations in the Flin Flon-Snow Lake area belt will be published in conjunction with the May, 1987 Annual Meeting of the Geological Association of Canada. A paper to be published in a technical journal was completed: "U-Pb zircon ages from the Lynn Lake and Rusty Lake metavolcanic belts, Manitoba: two ages of Proterozoic magmatism", by D.A. Baldwin, E.C. Syme, H.V. Zwanzig, T.M. Gordon, P.A. Hunt and R.D. Stevens. Results of the Flin Flon-Snow Lake investigations will be published upon completion.

FOLLOW-UP AND IMPLICATIONS:

In 1987 further analytical work will be conducted in the region, to provide a more comprehensive aspect to the data base now established. These age determinations will permit well documented and more precise interpretations to be made on the timing of geological events in the southern Churchill Province.

PROJECT 1.3/1.16: Rubidium-strontium geochronology in Manitoba

INVESTIGATOR: G.S. Clark, University of Manitoba

OBJECTIVES:

This is a continuation of work initiated in 1979 to determine Rb-Sr ages from lithotectonic domains of the Churchill and Superior Provinces in northern Manitoba. The establishment of a geochronological framework is an essential supplement to field mapping for constructing models of crustal evolution within the various domains and the relationship of the domains to one another, in order to identify the most favourable targets for future exploration programs.

This project will concentrate on rocks not datable by U-Pb method and on dating ultramafic events.

PROGRESS:

Six (6) samples of layered hornblende gneiss from Split Lake block have been analyzed isotopically. The scatter of data points precludes calculation of Rb-Sr isochron age, but an Archean age is indicated. Further analyses are planned. The low Rb-Sr ratios, ranging up to 0.04, strain the analytical precision of the present equipment.

Eleven (11) samples of the Fox Lake granite have been analyzed isotopically. Data points show considerable scatter and an age cannot be calculated, even though sampling was done on parts of the granite showing no evidence of shearing. The pluton shows considerable depletion in Rb which is consistent with the margin being generated from partial melting of an older Archean crust that is itself depleted in Rb, such as the layered hornblende gneiss above. The non-radiogenic outcrop of this body is also consistent with such an origin.

Several samples of pseudotachylite and hornfels from Cross Lake are being processed for analyses.

PRODUCTS:

Report in MGSB Report of Field Activities 1986.

FOLLOW-UP AND IMPLICATIONS:

Isotopic data, once completed will be integrated with other studies (geochemical, structural, U/Pb geochronology: see Projects 1.16.2, 1.11.3, C.1.1.4, C.1.1.5, C2.2.6). Whole rock Pb isochrons and Sm-Nd studies are planned.

Such data integration will provide an excellent basis for magma generation interpretations.

Data from the Cross Lake area will assist in determining genesis of rare-element-enriched pegmatites, Ti-V-enriched anorthositic gabbros and metamorphic events leading to potential gold mineralization.

PROJECT 2.2: Gold deposits, Johnson Shear

INVESTIGATORS: D.A. Baldwin

OBJECTIVES:

To establish the controls for gold mineralization along the Johnson Shear Zone.

PROGRESS:

Geological field investigations in the Wasekwan Lake, Franklin Lake and Foster Lake area are complete. Field data have been collated and portrayed on geological maps and stratigraphic sections. Subsurface data collected from diamond drill core have been incorporated in diagrams displaying stratigraphy and patterns of alteration. Geological data on host rocks to mineralization and on the mineralization are forthcoming.

PRODUCTS:

Preliminary results have been published in the Manitoba Energy and Mines, Minerals Division, Report of Field Activities 1986.

FOLLOW-UP AND IMPLICATIONS

During the 1987 field season the area of investigation will be extended westward to include Gemmell Lake and Wilmot Lake where anomalous Au and/or As values are known to occur. The Johnson Shear Zone may have a greater lateral extent than what is presently known.

PROJECT 2.4: Rock geochemistry, biogeochemistry and stratigraphy of the Agassiz Metallotect

INVESTIGATOR: M.A.F. Fedikow

OBJECTIVES:

To examine the feasibility of using detailed and regional biogeochemical surveys to establish mineral exploration targets in the Lynn Lake area.

To determine whether the trace element content of peat bogs can be used as an indicator to locate "blind" gold mineralization along the Agassiz Metallotect.

To map in detail the stratigraphy of known gold occurrences along the Agassiz Metallotect.

PROGRESS:

The feasibility of detailed biogeochemical surveys has been discussed in OF84-1 and 85-6. The geology of the MacLellan (Agassiz) deposit has been described in OF85-5. Additionally, the application of mercury-gas surveys to the search for gold along the metallotect has been attempted and reported on in OF85-11.

A report describing rock geochemical techniques used to distinguish gold-bearing from barren rocks along the Agassiz Metallotect and to determine the nature of the high Mg-Ni-Cr basaltic host rocks to the deposit is in preparation.

The use of black spruce bark as a vegetation geochemical exploration tool was examined in the Dot Lake area and found to be successful where appropriate drainage and overburden conditions are present. This information has been released as an open file report. The Spider Lake area has been ascertained to represent the easternmost extent of the Agassiz Metallotect as a result of detailed stratigraphic studies in the area. The results of this program were described in the 1986 Report of Field Activities. An open file report concerning rock geochemical studies at the MacLellan Au-Ag deposit is in preparation. This report will describe the trace and major element dispersion phenomena associated with the mineralized zones and attempt to ascertain the origin of the high Mg-Ni-Cr basalts.

PRODUCTS:

The results of this program are being released as open file reports as preliminary and final interpretations become available. Detailed stratigraphic sections and results of peat bog and vegetation geochemical studies are being prepared.

FOLLOW-UP AND IMPLICATIONS:

Recent discoveries of gold mineralization (Farley Lake, Dot Lake) along the Agassiz Metallotect, in addition to the MacLellan Mine, indicate enormous potential in these rocks for repetitions of Agassiz-type or other styles of gold mineralization. Stratigraphic and geochemical studies are to be continued along the entire metallotect in an attempt to identify more localized zones of higher gold potential.

PROJECT 2.5:**Industrial minerals evaluation, Lynn Lake area****INVESTIGATORS:**

W.R. Gunter and P.H. Yamada

OBJECTIVES:

To evaluate reported occurrences of sillimanite, garnet, building stone and other industrial minerals in the Lynn Lake/Leaf Rapids/Thompson area. The deposits will be sampled to determine the suitability of the material for industrial mineral use. Detailed mapping, sampling and possible diamond drilling will be conducted on those deposits considered to be geologically favourable.

PROGRESS:

Property evaluations in the Lynn Lake-Thompson region have been undertaken on (1) cordierite and other industrial minerals at the Ruttan Mine; (2) cordierite in the Nelson House area; and (3) marble in the Thompson area. These assessments are of a preliminary nature and are to be continued in more detail in 1987/88.

PRODUCTS:

A preliminary report (GS-35), in the 1986 Report of Field Activities, describes the findings in the Ruttan and Thompson areas. The value of industrial minerals as a mineral commodity has been communicated to geologists working in private industry. Several inquiries from the public have been received concerning cordierite from Nelson House and Ruttan as a possible gemstone, and marble from Pipe Lake Open Pit as possible facing stone.

Initial results warrant continuation of this project.

FOLLOW-UP AND IMPLICATIONS:

The detailed study of the Thompson marble occurrences will be continued in 1987/88. These studies are designed to quantify the volume of material present and to bulk sample the marble for quality testing, i.e. strength and resistance to abrasion. Preliminary investigations will be conducted to determine the building stone potential of the Thompson belt migmatites and a Livingston-type granodiorite south of Southern Indian Lake.

PROJECT 2.27: Remote sensing: Agassiz Metallotect

INVESTIGATORS: M.A.F. Fedikow
 D.T. Anderson (University of Manitoba)

OBJECTIVES:

To identify potential ore deposits buried beneath superficial clay deposits. Remote sensing techniques, using MEIS II and MSS spectral scanners, will determine if airborne detection of vegetation stress can be used to identify buried precious or base metal mineralization. The entire region underlain by the Agassiz Metallotect is to be investigated.

PROGRESS:

Set-up of the Image Analysis System at the University of Manitoba has been delayed due to the move of the Department of Earth Sciences to a new building. Nevertheless, one student is currently undertaking studies related to the integration of multispectral remote sensing and geological data.

As part of the Agassiz Metallotect Remote Sensing project detailed bedrock geology, surficial geology, vegetation distribution, INPUT electromagnetic data, and vertical field gradiometer data are currently being digitized. These data will be integrated with multispectral MEIS II data when the Canada Centre for Remote Sensing flies the Agassiz Metallotect this summer.

PRODUCT:

Hard data tapes containing raw data from remote sensing. Residual anomaly maps indicating sites of metal-induced stress in vegetation.

FOLLOW-UP AND IMPLICATIONS:

1. Airborne Survey of the Agassiz Metallotect by the Canada Centre for Remote Sensing.
2. Acquisition of the data tapes.
3. Merging remote sensing data with digitized geological, geophysical and geochemical data.
4. Computer-aided manipulation of acquired data is continuing.

In 1986-87 the project is to be coordinated and funded by the GSC as Project C.2.1.3.

PROJECT 2.29: Mineral deposit documentation, Lynn Lake Area

INVESTIGATORS: D.A. Baldwin

OBJECTIVES:

To establish the geological setting and controls on mineralization of selected mineral deposits in the Lynn Lake area.

PROGRESS:

Field studies in the Sheila Lake, Margaret Lake, Motriuk Lake area have been completed. Stratigraphic sections have been prepared and the lateral continuity of a previously known, stratabound, disseminated sulphide zone has been extended. Geochemical analyses of the mineralization have not identified any anomalous values of base or precious metals. However, high Mg-Ni-Cr basalts similar to those at the MacLellan Mine have been identified.

Investigations of mineral occurrences in the Lynn Lake rhyolite were defined because of the urgency for geological interpretations on mineralization encountered at the West Anomaly at the Ruttan Mine.

PRODUCTS:

Preliminary results of the investigations at Sheila Lake, Margaret Lake and Motriuk Lake have been published in the Manitoba Energy and Mines, Minerals Division, Report of Field Activities 1986. West Anomaly data and interpretations have been presented to the authorities concerned.

FOLLOW-UP AND IMPLICATIONS:

Additional field work in the "northern belt" of the Lynn Lake belt will be aimed at the identification of stratigraphy and high Mg-Ni-Cr basalts with the purpose of investigating the possibility that the Agassiz Metaltect may extend farther westward than is presently known.

PROJECT 4.1: Basal till investigations, Ruttan-Nickel Lake and Great Island areas

INVESTIGATOR: E. Nielsen

OBJECTIVES:

To continue the evaluation of till geochemistry as a method of exploration for base and precious metals. Case studies of glacial dispersion are implemented in and adjacent to known mineral occurrences. In addition, till geochemical anomalies are mapped in selected areas of little or no outcrop to aid in the search for mineralization.

PROGRESS:

Field work in the Nickel Lake, Ruttan and Great Island areas resulted in 78 till samples being collected. The clay-sized and heavy mineral fractions of the 34 samples collected from Great Island have been analyzed.

Analysis of the Nickel Lake and Ruttan samples is ongoing and to date only gold and arsenic are completed.

PRODUCTS:

Open File Report OF87-1 detailing the results of the Great Island study is finished.

An extended abstract highlighting the results of the Great Island study was distributed at the Prospectors and Developers Association meeting in Toronto (March 1987).

FOLLOW-UP AND IMPLICATIONS:

The Nickel Lake study which revealed a large arsenic anomaly but no appreciable gold is finished and no further field work is planned. The Ruttan project which revealed a large arsenic and gold anomaly down-ice from the Vol Fault is ongoing and will be extended along strike in the 1987 field season.

Manitoba Minerals and Sherritt Gordon are contributing their till sampling programs in the Lynn Lake area. Esso Minerals is planning a till sampling program in the Rusty Lake area in the upcoming field season. Falconbridge took out a permit in the Great Island area the day after the till geochemical results were made available at the Meeting with Industry in November and are planning an extensive overburden sampling program this summer.

PROJECT 4.3: Basal till investigation - Agassiz Metallotect, Lynn Lake

INVESTIGATORS: M.A.F. Fedikow and E. Nielsen

OBJECTIVES:

To evaluate the geochemistry of heavy mineral separates and clay-sized fractions of basal till samples as an exploration method for gold mineralization along the Agassiz Metallotect.

PROGRESS:

Helicopter-supported reconnaissance sampling along the Agassiz Metallotect was completed during this past field season. Heavy mineral separates and gold counts have been completed as well as AAS and INAA analysis of the clay-sized fraction of the till samples.

PRODUCTS:

Preliminary findings are being released as open file reports detailing the results of this program along the 65 km metallotect. One open file report has already been released (OF85-3) and others are in preparation. Other open file reports examining geochemical exploration methods along the metallotect include OF84-1, 85-5, 85-6 and 85-11. The remainder of the basal till examinations will also be released as open file reports.

FOLLOW-UP AND IMPLICATIONS:

The recognition of 65 km of gold-bearing rocks required a thorough evaluation of this stratigraphy for repetitions of the target formations. The presence of the Dot Lake deposit and the producing MacLellan Mine indicates significant concentrations of gold exist in these rocks. The recent discovery of significant gold mineralization at Farley Lake 39 km east of the MacLellan Mine within the Agassiz Metallotect is further testimony to the need for ongoing studies.

PROJECT 5.1: 1:250 000 Synoptic geological compilation Lynn Lake-Ruttan

INVESTIGATORS: H.V. Zwanzig, D.E. Kowerchuk*

OBJECTIVES:

Under the compilation program all available geological data for the Lynn Lake and Ruttan areas will be synthesized and plotted at a scale of 1:250 000. The main objective is to produce a coherent, large-scale map from the numerous available geological maps at their various scales and levels of complexity. This map will provide a regional perspective of the geology for mineral exploration.

* D. Kowerchuk took over from S. Parker.

PROGRESS:

After compilation of the first map sheet NTS 64B, revisions were implemented for 64C. Systematic guidelines were prepared under which NTS 64C was redrafted and 64B was drafted as rough-copy maps. Marginal notes were prepared, describing stratigraphy, structure, zircon ages and important mineral deposits. Drafting and printing were completed for 64B and 64C.

PRODUCTS:

NTS 64C was printed.

FOLLOW-UP AND IMPLICATIONS:

Standardized conventions and techniques have been established to prepare future maps in the series.

Marginal notes provide a condensed geological history for the Lynn Lake-Ruttan region, using modern geotectonic concepts.

PROJECT 5.1.2: 1:250 000 geophysical compilation, Churchill River

INVESTIGATORS: M.T. Corkery, D.E. Kowerchuk, P.G. Lenton

OBJECTIVES:

To synthesize and compile all geological data of Lower Churchill River area (NTS 64H, 54E). See Project 5.1 for further details.

PROGRESS:

Data were compiled.

PRODUCT:

Maps ready for final cartography.

FOLLOW-UP AND IMPLICATIONS:

Preparation of marginal notes, cartographic work and printing. These maps will extend coverage of 1:250 000 synoptic compilation series of northern Churchill; NTS 64G and 64F to follow.

PROJECT 5.3: Lynn Lake report and maps

INVESTIGATOR: H.V. Zwanzig

OBJECTIVES:

Geological maps and technical reports describing the geology and mineral occurrences in the Lynn Lake-Ruttan region are to be prepared in order to aid, and focus mineral exploration in this region.

PROGRESS:

Maps for 64C/5 (Kamuchawie Lake) and 64C/6 (Kadeniuk Lake) have been prepared for drafting. Petrographic work is in progress for the Granville Lake area.

PRODUCTS:

A report on the sedimentary rocks in the Lynn Lake area is 90% complete. Three new, preliminary U-Pb ages have been obtained from the University of Kansas.

FOLLOW-UP AND IMPLICATIONS:

Reports describing the structure and zircon geochemistry for the Lynn Lake area and describing geology between Kamuchawie and Granville Lakes are to be completed.

GEOLOGICAL SURVEY OF CANADA

PROJECT C.1.1.2: Metamorphism in the Lynn Lake-Laurie Lake area

INVESTIGATORS: T.M. Gordon (LCSD)
S.L. Jackson (Queen's U.)

OBJECTIVES:

To elucidate the metamorphic history of rocks on the southern flank of the Lynn Lake greenstone belt. Thesis study of mineral assemblages and mineral compositions in pelitic and mafic rocks of the Wasekwan Group to document the chemical and mineralogical changes and pressure-temperature conditions during metamorphism and the relationship of metamorphism to deformation.

PROGRESS:

Field work was essentially completed this year. The muscovite + quartz to K-feldspar + sillimanite isograd was delineated and sufficient material collected to study the reaction mechanism, relationship to deformation and timing of tectonism at the boundary between the Lynn Lake belt and Burntwood belt. West and south of McGavock Lake, Steve Jackson has delineated an 8 km long Fe-Mg-rich alteration zone within the felsic gneisses. This is probably the largest alteration zone found to date in the Lynn Lake region.

PRODUCTS:

S.L. Jackson presented his results to date at a preliminary meeting of the Trans-Hudson Orogen Lithoprobe group in Winnipeg in April, 1986.

A paper "Metamorphic studies in the transition zone between the Lynn Lake greenstone belt and the Kiseynew gneiss belt, Laurie Lake, Manitoba" by S.L. Jackson and T.M. Gordon was published in Current Research 86-1B.

Steve also presented a poster at the Manitoba Meeting with Industry.

FOLLOW-UP AND IMPLICATIONS:

Steve will be completing his field studies this year. The recognition of supracrustal rocks and volcanogenic alteration zones within the Kiseynew gneiss belt will allow explorationists to extend their search for massive sulphide deposits into these high grade rocks.

PROJECT C.1.1.3: U/Pb geochronology, Churchill Province

INVESTIGATORS: T.M. Gordon (LCSD)
P.A. Hunt (LCSD)

OBJECTIVES:

To sample selected areas for subsequent zircon U/Pb work (e.g. 1984 Flin Flon-Snow Lake area). Work over time of agreement will complement other GSC and ERDA projects and will be arranged in consultation with Manitoba.

PROGRESS:

Field work included collection of four samples from the Lynn Lake-Burntwood boundary zone, three samples from the Kiseynew gneiss belt and three samples from the eastern end of the Flin Flon-Snow Lake belt.

Laboratory work resulted in seven new age determinations. These results demonstrate peak metamorphism in the Burntwood terrane postdates subaerial volcanism in the Flin Flon belt.

PROJECTS:

Data were presented at the GAC/MAC '86 in Ottawa and as a poster at the Manitoba Meeting with Industry in November 1986; a paper has been accepted for publication in the Canadian Journal of Earth Sciences.

Data were presented also to Friends of the Nickel Belt workshop, April 1986.

FOLLOW-UP AND IMPLICATIONS:

Samples on hand will be processed this fiscal year. Further sampling may take place in the Flin Flon, Lynn Lake and Burntwood belts.

Results to date will be presented at Saskatoon '87 and at a Geological Society of London meeting in Dublin in September. Samples obtained from Project Cormorant will be processed if suitable material is obtained. Future work will concentrate on the chronology of volcanism and deformation in the Flin Flon-Snow Lake belt and adjoining Kiseynew rocks.

The results of this program, combined with the age-dating program in Saskatchewan, will greatly increase our knowledge of the tectonic history of the entire southern Churchill Province. This will have far-reaching implications for explorationists, allowing them to correlate favourable metal-rich environments across large distances.

PROJECT C.2.1.3: Agassiz remote sensing research

INVESTIGATORS: A. Rencz (MRD)
D.T. Anderson (U. of M.)

OBJECTIVES:

To evaluate the contribution of integrated multitype data analysis to geological mapping and mineral exploration using a portion of the Lynn Lake volcanic belt from the MacLellan Mine to the Farley deposit. The digital image analysis system at University of Manitoba will be used to integrate the data available from this region.

PROGRESS:

Contract was awarded to University of Manitoba to investigate the Lynn Lake gold belt using data integration techniques and airborne remote sensing. Data sets have been acquired for basal till geochemistry, vegetation chemistry, lake sediment chemistry, rock chemistry, gradiometer data and MEIS airborne data. Data sets are now being digitized and registered on the DHIX image analysis system at the University of Manitoba.

PRODUCT:

Hard data tapes containing integrated data.

FOLLOW-UP AND IMPLICATIONS:

Investigations of relationships between data sets to evaluate their contribution to geological mapping and mineral exploration. By integrating data from this multidisciplinary study, explorationists may recognize potential gold deposits not only between the two major occurrences already being developed, but also along the eastern and western extensions of this gold belt that are covered by overburden.

PROJECT C.4.1.4: Quaternary geochemistry

INVESTIGATORS: R.N.W. DiLabio (TSD)
C.A. Kazsycki (TSD)

OBJECTIVES:

To estimate the influence of glacial Lake Agassiz clays on the geochemistry of Recent lake sediments.

PROGRESS:

Several cores of lake sediments have been extruded and subsampled and are now ready for analysis. Deep coring of lakes will not be done because of a shortage of funds and time.

FOLLOW-UP AND IMPLICATIONS:

Geochemical and palynological analysis of archived cores from selected lakes in the Lynn Lake-Leaf Rapids area. This will show the depositional history and geochemical response of Holocene lake sediments in relation to the presence and absence of Lake Agassiz deep-water (varved) clays. The results of this study will allow explorationists to better understand the effect of clay-rich terranes on the geochemistry of lake sediment samples.

DISTRICT II: FLIN FLON-SNOW LAKE

Summary and Project Listing:

Detailed mapping, sampling, and mineral deposit investigations focussed on the Vamp, Tartan Lake, Baker Patton, Neso Lake, Twin Lake, and Fay Lake deposits. At Tartan Lake, the recognition of a distinctive zonation in the shear zones, and pattern of alteration, will assist the search for extensions to the shear zones containing the main mineralization. Data are being compiled into an open file report.

Preliminary geological maps of volcanogenic sulphide mineralization were prepared for the Baker Patton and Fay Lake occurrences. Additional geochemical data for Baker Patton have been obtained; previously acquired data are partially synthesized and petrographic studies are complete.

In the Snow Lake region, the bulk of data acquisition for preparation of 1:50 000 and 1:20 000 scale metallogenic maps has been completed. Further evidence was obtained supporting the concept that polymetallic quartz veins, within or close to mafic volcanic rocks containing Cu-Zn massive sulphide deposits, represent a genetically associated 'leakage' or 'sweat-out' alteration phenomenon.

Industrial minerals investigations focussed on garnet and sillimanite deposits at Star Lake, talc at Iskwasum Lake, dolomite south of the exposed Flin Flon and Snow Lake greenstone district, and kaolin associated with the Paleozoic unconformity.

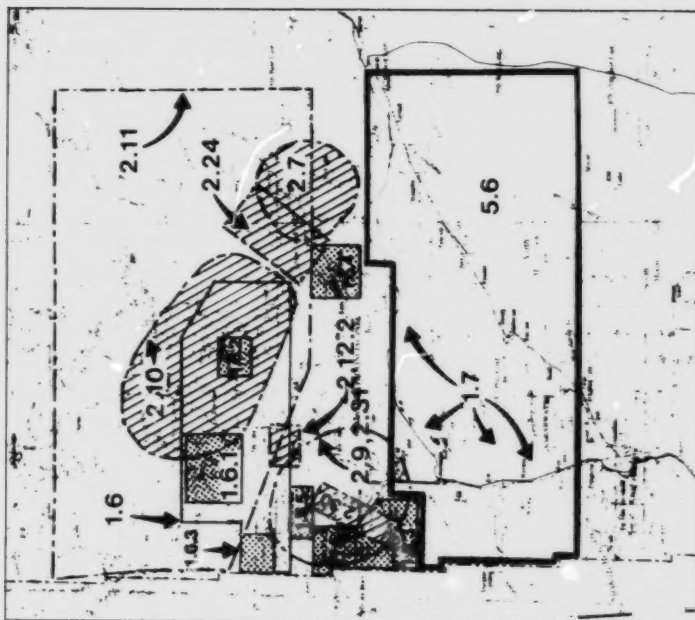
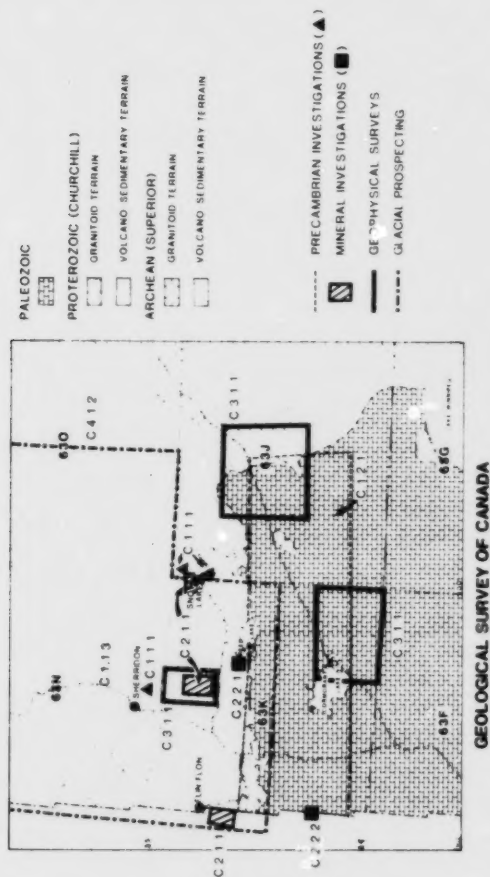
Mineral deposit studies in the Kiseynew terrain entailed detailed mapping of selected mineral occurrences at Puffy, Walton, and Evans Lakes as well as a reconnaissance north of Nokomis Lake and south of Walton Lake. It is now apparent that quartzofeldspathic gneisses may locally occur within the so-called Nokomis greywacke sequence; however, the structural as opposed to stratigraphic controls on this more complex configuration have yet to be resolved.

A standard format for the Mineral Deposit Map Series has been formulated and second drafts of two 1:20 000 mineral deposit maps of the Flin Flon area are being prepared.

Mapping at a scale of 1:20 000 in the Flin Flon region extended coverage into the Athapapuskow Lake area and confirmed the principal structural control by major block-bounding faults of several different ages, as well as the difficulty of correlating stratigraphy and mineralized zones between fault blocks.

A combination of 1:20 000 and reconnaissance mapping of the Tartan and Aimée Lakes area established the late emplacement age of the gabbro complex which hosts the sulphide and gold mineralization.

Continuing work in the Kiseynew Lake area provided further confirmation that a single mineralized metallotect is an oversimplified concept since the paragneissic sequences contain numerous amphibolite layers at different levels within the intensely deformed migmatitic complex. A unit



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1.5	1:20 000 mapping Flin Flon, etc.
1.5.3	1:20 000 mapping Athapuskow Lake
1.5.4	1:20 000 mapping Chisel Lake
1.5.5	Tartan Lake geological mapping
1.6.1	1:20 000 Kisseling Lake mapping
1.6.2	1:20 000 Moody Lake mapping
1.6.3	1:20 000 Kisseling Lake west mapping
1.7	Scout drilling, Project Cormorant
2.7	Gold deposits Snow Lake area
2.9	Deposit documentation Flin Flon
2.10	Deposit documentation Sherridon
2.11	Industrial minerals evaluation
2.12.2	Vamp Lake deposit
2.24	Copper-Zinc deposits, Snow Lake area
2.30	Mineral deposit geology, Flin Flon area
2.31	Metallogeny felsic intrusions
5.6	Subpaleozoic compilation

Figure 5: Location of Sector A projects (1986) - DISTRICT II: FLIN FLON - SNOW LAKE

of metamorphosed feldspar-phyric basalt at Weasel Bay, and a metamorphically armoured norite intrusion south of Imperial Lake, may represent northern extensions of the Amisk Group and Boundary Intrusions, respectively.

On Kississing Lake intensive documentation of shoreline exposures seems to confirm the existence, at a regional scale, of the three principal lithologic associations defined by earlier workers (garnet-biotite-graphite gneiss, amphibolites, and quartzofeldspathic gneiss). However, in detail this simplistic grouping appears invalid and numerous instances occur where units appear out of sequence and with little along-strike continuity. Preliminary interpretations of structural history indicate at least three folding events (recumbent, isoclinal, cross-folding), the latter with associated brittle deformation. Mineral occurrences/conductors appear associated with the amphibolite sequence, especially in areas of considerable deformation intensity.

Geological mapping at a scale of 1:15 840 in the Chisel-Morgan Lakes area, delineated several major fault structures and identified more than one age of synvolcanic quartz-phyric tonalite displaying Fe-Mg alteration networks. A direct though tentative corollary to this is the inference that associated hydrothermal activity (and hence mineralizing events), may have spanned a considerable time interval during the evolution of the Flin Flon-Snow Lake greenstone belt and consequently mineral deposits may occur at several rather than a single stratigraphic level in the volcanic sequence.

Close to 400 samples collected from granitic intrusives in the Flin Flon belt are being analyzed at the University of Manitoba as the initial step of a longer term program to geochemically categorize the felsic intrusions of this region and evaluate their metallogenic potential.

Ten additional drill holes were put down south of Athapapuskow Lake as a continuation of the sub-Paleozoic compilation in the Project Cormorant area. Evaluation of Taiga's geological compilation, and gradiometer data, is continuing to generate new insights into the basement geology, and suggests the existence of a high-grade gneissic domain south and west of the main greenstone belt.

GSC

A comprehensive array of programs was also delivered by the Geological Survey of Canada as the Federal contribution to the MDA. These included several new aeromagnetic gradiometer surveys of the Elbow Lake, Hargrave River, and Moose Lake regions near Flin Flon.

Regional till sampling and surficial mapping continued in NTS areas 63N, 63-0 (W 1/2), 64B (S 1/2) and the north half of 63K near Flin Flon. The Terrain Sciences Division continued research into the influence of glacial Lake Agassiz clays on the geochemistry of recent lake sediments, including deep coring of several lakes to assess vertical geochemical variations and possible vertical pathways for metal migration.

Alteration zones associated with volcanogenic massive sulphide deposits were examined in the Flin Flon, and Snow Lake areas.

U-Pb ages have been determined for several key units in the southern Churchill Province and others are near completion.

Mineral investigations in the Flin Flon-Snow Lake area involve the study of gold metallogeny, the metallogeny of mafic and ultramafic rocks and the study of deep footwall alteration zones below massive sulphide deposits.

A Master's degree will be completed at Carleton University on the pervasive silicification of rocks deep in the footwall to the Chisel Mine. Gold studies involved mapping of areas containing gold deposits in the Elbow Lake and Snow Lake regions, as well as around Phantom Lake, in Saskatchewan.

A university of Manitoba study, characterizing the mafic and ultramafic intrusions in the Flin Flon-Snow Lake belt, concentrated this year on the Reed Lake Pluton.

The Namew Lake PGE-nickel deposit was also investigated.

In March 1987, the GSC mounted an extensive "scout drilling" program in the "Project Cormorant" area south of Flin Flon.

GSC staff will also contribute several papers to the GAC/MAC symposia on "Gold in Central Canada" and the "Trans-Hudson Orogen", making extensive use of data generated through MDA's in Manitoba and Saskatchewan.

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PROJECTS 1.5.1 and 1.5.2: 1:20 000 scale geological mapping,
 Flin Flon area

INVESTIGATORS: A.H. Bailes and E.C. Syme

OBJECTIVES:

The objective of this project is to provide a sound geological data base for future mineral exploration in the Flin Flon base metal (and gold) mining camp. A major goal, in addition to the production of high quality 1:20 000 scale geological maps, is to stratigraphically subdivide the Amisk Group volcanic supracrustal rocks and place mineral deposits within this stratigraphic framework. A further goal is to identify the environmental conditions that existed at the time of mineralization with a view to determining those conditions that were favourable to deposition of the mineral deposits.

PROGRESS:

In 1986 all activities were directed towards completing a report. A first draft of the report has been completed.

PRODUCTS:

A final map with marginal notes has been printed. The final report, scheduled for completion in 1988, will contain all the pertinent information and conclusions required by mineral exploration companies.

FOLLOW-UP AND IMPLICATIONS:

Activity in 1987/88 will be directed entirely towards preparation of a final report on the Flin Flon-White Lake area. This report and accompanying

map will provide a significant upgrading of the geological data base for the Flin Flon mining camp, such that future exploration in this area can proceed in a rational and productive manner. The stratigraphic subdivisions of Amisk Group volcanic rocks can be extended beyond the immediate map area and should provide a sound basis for future geological projects in the Flin Flon district.

PROJECT 1.5.3: 1:20 000 scale geological mapping, Athapapuskow Lake area

INVESTIGATOR: E.C. Syme

OBJECTIVES:

The primary objective of this project is to provide an updated and detailed geological data base for future base metal and gold exploration in the Flin Flon area. To that end, specific goals include: production of high quality 1:20 000 geological maps, definition of Amisk Group volcanic stratigraphy and its relationship to the stratigraphy now established in the Flin Flon area (Bailes and Syme, in prep.), definition of stratigraphic and structural setting of mineral occurrences, definition and extension of the major faults and folds which dominate the structure in the Flin Flon area, and geochemistry and geochronology of igneous units.

PROGRESS:

In 1986 a full field season was spent mapping Amisk Group rocks in the Schist Lake portion of the area. Selected volcanic and intrusive units have been analyzed for major, minor, trace and rare earth elements.

PRODUCTS:

Results of this year's work are summarized in Report of Field Activities 1986 - GS-8: Schist Lake area (Athapapuskow Project) - accompanied by 1:15 840 scale Preliminary Map 1986F-1.

FOLLOW-UP AND IMPLICATIONS:

Another field season will be spent mapping in the area in 1987. A preliminary map and report summarizing the summer's findings will be given in the 1987 Report of Field Activities. This project will build upon the stratigraphic and structural base now established in the Flin Flon area (Bailes and Syme, in prep.) to provide a better understanding of the western Flin Flon-Snow Lake metavolcanic belt.

PROJECT 1.5.4: 1:20 000 scale geological mapping, Chisel Lake-Morgan Lake area

INVESTIGATOR: A.H. Bailes

OBJECTIVES:

The objective of this project is to provide a much improved geological data base for future mineral exploration in this base metal- and gold-rich mining district. A major goal is the development of a coherent regional volcanic stratigraphy and the identification of the position of mineral deposits within this stratigraphic framework. A further goal is to document the distribution and main characteristics of hydrothermal alteration zones associated with known and, as yet, undiscovered mineralized zones. Where possible, the environmental conditions that existed at the time of

mineralization will be identified with a view to determining those conditions favourable to deposition of mineral deposits.

PROGRESS:

In 1986 approximately 75 km² of the Chisel Lake-Morgan Lake area was mapped during a three month field season. Most activities were directed towards production of a preliminary map (1986S-1) and a written contribution to the 1986 Report of Field Activities (GS-15).

Mapping has demonstrated that the eastern two-thirds of the area consists of a folded, dominantly north-facing, 4 km thick sequence of volcanic rocks in which known massive sulphide deposits occur near the base, middle and top of the section. The western third of the area is structurally and stratigraphically more complex. A number of synvolcanic felsic plutons have been identified and it appears that hydrothermal alteration and deposition of massive sulphide deposits were probably related to emplacement of these plutons.

PRODUCTS:

In 1986, a preliminary map (1:15 840 scale) and a report (GS-15), in the Manitoba Energy and Mines 1986 Report of Field Activities, were published. An oral presentation on the results of this project was given during the November Open House, in Winnipeg. Some of the results of this project are being published in a field trip guidebook (Trip #1, 1987 GAC-MAC Annual Meeting, Saskatoon).

FOLLOW-UP AND IMPLICATIONS:

In 1987, the 1:15 840 mapping of the Chisel-Morgan Lake area will be completed during a three month field season. Results of this mapping will be released as a preliminary map and in 1987 Report of Field Activities.

Mapping in the area will significantly upgrade the existing geological data base, such that future exploration can proceed in a rational and productive manner.

PROJECT 1.5.5: Tartan Lake mapping

INVESTIGATOR: H.P. Gilbert

OBJECTIVES:

To provide an up-to-date detailed geological data base in the northwestern part of the Flin Flon belt in well exposed areas of known and potential gold and base metal mineralization

PROGRESS:

Mapping was initiated during a half field season covering Tartan Lake-Lac Aimée and Mikanagan Lake.

PRODUCTS:

Preliminary Map Tartan Lake-Lac Aimée 1:15 840.
Report (GS-9) in Report of Field Activities 1986.

FOLLOW-UP AND IMPLICATIONS:

Mapping will be conducted at 1:15 840 in 1987 from Embury Lake to Lac Aimée to provide complete coverage of western part of Flin Flon belt in connection with Projects 1.5.1, 1.5.2 and 1.5.3.

PROJECT 1.6.1: 1:50 000 scale geological mapping of the Kississing Lake area

INVESTIGATOR: D.C.P. Schledewitz

OBJECTIVES:

The objective is to improve the existing mapping by providing a consistent and sound data base to assist mineral evaluation studies and exploration. A major objective is to delineate, in detail, the variations and lithologic relationships with rocks of the past base metal-producing Sherridon map area to the east.

PROGRESS:

Fieldwork concentrated on the west half of Kississing Lake area in 1986.

PRODUCTS:

A preliminary map at 1:20 000 scale covering west half of Kississing Lake area and a report with a compilation map figure were produced as part of the Report of Field Activities, November 1986.

FOLLOW-UP:

Continuation of mapping in 1987 in southeastern part of map area.

A final map at 1:50 000 scale and a final report dealing with the mineral potential, and lithostratigraphic considerations encompassing aspects of the geology of adjacent areas, including metamorphic, structural and igneous history, is projected for 1989.

IMPLICATIONS:

Preliminary results indicate that several types of mineralization occur. One type may be stratabound whereas others appear to be structurally controlled and may have been mobilized from stratabound mineralization.

PROJECT 1.6.2: Kisseynew East, geological mapping

INVESTIGATOR: H.V. Zwanzig

OBJECTIVES:

The purpose of this project is to provide structural and stratigraphic control for the base and precious metal deposits in the Kisseynew Lake-Sherridon Lake region of the Kisseynew metasedimentary gneiss belt. The investigation will establish a stratigraphic subdivision of the Sherridon Group, separate the Nokomis Group from the granitoid complexes and trace out the Amisk Group at the margin of the Flin Flon volcanic belt. A major goal is to test whether gold deposits in the area occur consistently along one stratigraphic unit established by the new mapping or whether there is structural control.

PROGRESS:

No field work was conducted in 1986 due to health problems.

PRODUCTS:

Results of previous years were included in Abstract for GAC Annual Meeting 1987.

FOLLOW-UP AND IMPLICATIONS:

The mapping will be continued in 1987 to cover Moody Lake, Batty Lake and Limestone Point Lake.

PROJECT 1.6.3: Kisseynew West

INVESTIGATOR: W.D. McRitchie

OBJECTIVES:

To establish the stratigraphy, lithology, structure and mineral potential in an area apparently containing stratabound gold mineralization, in support of more effective targeting by mineral exploration.

PROGRESS:

A two-week field season focussed on the Spike Lake 'dome' and the region to the south. Continuing work on the Kisseynew Lake area provided further confirmation that a single mineralized metallotect is an oversimplified concept since the paragneissic sequences contain several amphibolite layers at different levels within the intensely deformed migmatitic complex. A unit of metamorphosed feldspar-phyric basalt at Weasel Bay, and a metamorphically armoured norite-pyroxenite intrusion at Imperial Lake, may represent northern extensions of the Amisk Group and Boundary Intrusions, respectively.

PRODUCTS:

Two-page progress report in 1986 Report of Field Activities with updated 1:50 000 provisional compilation. Twelve chemical analyses for the Imperial Lake norite.

FOLLOW-UP AND IMPLICATIONS:

Project will be concluded as reconnaissance in 1987, when new Manfor roads will be used, in Florence Lake region, to link lithologies, structure and stratigraphy in Manitoba with those recently defined in Saskatchewan.

PROJECT 1.7: Scout drilling, Project Cormorant area

INVESTIGATORS: H.R. McCabe, W. Weber, W.D. McRitchie,
I. Hosain and D. Berk

OBJECTIVES:

To assist in determining the geology of the Precambrian basement in an area of thin Phanerozoic sedimentary cover, by means of an in-house diamond drilling core hole program. This program is designed to ground-truth geophysical signatures detected by the airborne gradiometer surveys of the Cormorant area.

PROGRESS:

During the 1986 field season, a three-man drill crew, using a truck mounted JKS-300 diamond drill rig, completed a total of 10 vertical holes to Precambrian basement, on targets defined on the basis of airborne gradiometer maps. Prior to drilling, detailed ground magnetometer profiles were run at each site to determine the precise core hole location. Total drilling

amounted to 544 m. Total Precambrian drilled was 171 m, an average of approximately 17 m per hole.

PRODUCTS:

All core has been placed on open file in the Department's core and sample library, and preliminary results of the drilling published in the 1986 Report of Field Activities. Petrographic slides and cores are available for examination on request.

FOLLOW-UP AND IMPLICATIONS:

Drilling of the 10 road-accessible targets in 1987 based on the geological compilation report by Taiga Consultants. Core from three holes was submitted to the GSC Geochronology Lab for U-Pb age determination on granitoid rocks.

PROJECT 2.7: Gold deposits, Snow Lake area

INVESTIGATOR: M.A.F. Fedikow

OBJECTIVES:

To determine the geological controls of gold deposits in the Snow Lake area.

To establish the nature and genesis of those gold deposits and investigate possible exploration methodology for detecting similar types of gold mineralization.

PROGRESS:

The preliminary examination of virtually all gold occurrences in the Snow Lake area has been completed. In the following two years it is expected that more detailed studies on selected gold occurrences will be started.

PRODUCTS:

The preliminary findings stemming from field examinations in 1984, 1985 and 1986 are presented in the Report of Field Activities. Detailed occurrence locations, geological maps and assay and geochemical results are available for inspection in a mineral deposit open file. Mineral deposit maps for the Snow Lake area, utilizing this information, are in preparation.

FOLLOW-UP AND IMPLICATIONS:

Detailed mineral occurrence studies on specific occurrences will commence with the completion of preliminary examinations in 1986. Progress reports describing the new findings will be released in the Report of Field Activities and in open file reports so that mining and exploration companies will be able to utilize relevant mineral occurrence information.

PROJECT 2.9: Mineral occurrence documentation - Flin Flon area

INVESTIGATOR: G.H. Gale

OBJECTIVES:

This project is designed to provide detailed geological maps and descriptions of all known mineral occurrences in the Flin Flon area, provide a genetic classification of deposits and delineate geologically favourable

mineralized zones on 1:50 000 scale and 1:20 000 scale maps for further investigations.

PROGRESS:

Over 95% of the mineral occurrences in the 63K/11, 63K/12, 63K/13 and 63K/14 map sheets have been investigated in a preliminary manner with documentation of basic rock types and mineral deposit features. In 1986 detailed studies of specific deposits involved 4-5 weeks of field work on the Tartan Lake, Neso Lake, Fay Lake and Twin Lake occurrences.

PRODUCTS:

The 1986 Report of Field Activities provides brief descriptions of individual properties. An active mineral deposit file for each occurrence contains detailed geological maps, accurate locations, and assay and rock geochemical data.

FOLLOW-UP AND IMPLICATIONS:

Investigations of specific deposits will continue for several years as new geological problems are identified. This work will entail detailed mapping at scales of 1:1000 and 1:5000. It is anticipated that each major deposit study, i.e. 1:5000 scale studies such as the Tartan Lake investigation, will result in an open file report as soon as the data are available to ensure quick release to the mining and exploration community.

PROJECT 2.10: Kisseynew sedimentary gneiss terrain

INVESTIGATOR: G. Ostry

OBJECTIVES:

To provide a mineral deposit data base, identify geological factors controlling mineralization, and classify mineral occurrences into genetic types.

To establish the stratigraphic position of mineralization and determine stratigraphy on the southern flank of the Kisseynew sedimentary gneiss terrain.

To identify specific metallotects for further investigations.

PROGRESS:

Mineral deposit documentation has been completed in the Walton and Puffy Lakes area. Mineral deposit maps for the File Lake area are in preparation.

Detailed 1:5000 scale mapping was initiated in the vicinity of the Puffy Lake gold deposit and at Evans Lake.

PRODUCTS:

Descriptions of mineral occurrences in the Walton Lake and Puffy Lake areas of the Kisseynew gneiss terrain are contained in Report GS-20 in the Report of Field Activities 1986. Individual files containing detailed maps, assay/geochemical results and written descriptions have been produced for each documented occurrence.

FOLLOW-UP AND IMPLICATIONS:

Further detailed mapping will be carried out in selected areas to define the overall stratigraphy on the southern flank of the Kisseynew

sedimentary gneiss terrain and the position(s) of mineralization within that stratigraphy. Thin section work and lithogeochemical sampling will continue to classify the rock types encountered and, in particular, the amphibolites which appear to be spatially related to the known mineralization. Both laboratory and field data will be synthesized to develop genetic models for the Kiseynew-type stratabound precious and base metal mineralization. Effective mineral exploration techniques for precious and base metal mineralization will evolve from the development of these genetic models and an understanding of the factors controlling the mineralization on the southern flank of the Kiseynew sedimentary gneiss terrain.

PROJECT 2.11: Industrial minerals investigations, Flin Flon-Snow Lake region

INVESTIGATORS: W.R. Gunter and P.H. Yamada

OBJECTIVES:

The purpose of this project is to evaluate reported occurrences of building stone, sillimanite, and garnet in the Flin Flon-Snow Lake area. The deposits will be sampled to determine the suitability of the material for industrial mineral use, and those deposits indicating potential will be examined in more detail. Additional examinations will take the form of detailed mapping, sampling and possibly diamond drilling.

PROGRESS:

Property evaluations in the Flin Flon-Snow Lake region have been undertaken on: (1) garnet-anthophyllite units at Star Lake-Elken Lake; (2) the talc occurrences on Iskwasum Lake; (3) dolomite deposits in the Wekusko-Cranberry Portage area; and (4) other minor reported occurrences.

PRODUCTS:

A preliminary report (GS-17) in the 1986 Report of Field Activities describes the findings in the Flin Flon-Snow Lake area. A second product is an increased awareness of the value of industrial minerals among the geologists of the region. Several inquiries from the public have been received concerning dolomite from Ponton as a carving stone, garnet from Star Lake-Elken Lake for water filtration, and sillimanite from this deposit as a refractory raw material.

Initial results warrant continuation of this project.

FOLLOW-UP AND IMPLICATIONS:

A detailed study of the garnet-anthophyllite unit at Star Lake-Elken Lake, including partial supervision of an M.Sc. thesis, will be undertaken. A study of the building stone potential of the dolomites in the Cormorant Lake area and the anorthosites and gabbros of the Cross Lake area will be commenced.

PROJECT 2.12.2: Geological setting, Vamp Lake deposit

INVESTIGATORS: P. Laznicka, R. Wadien (G.H. Gale)

OBJECTIVES:

To provide a detailed geological description and interpretation of the gold-bearing massive sulphide deposit at Vamp Lake.

PROGRESS:

Geological mapping at 1:10 000 of the general area was completed in 1985. Portions of the area were remapped in 1986. Petrographic and geochemical studies are in the final stages of completion.

PRODUCTS:

- Geological map at 1:10 000 scale.
- Report of Field Activities describing the general geology of the area.
- Year-end technical report is in preparation but has not been received to date.

FOLLOW-UP AND IMPLICATIONS:

M.Sc. thesis completion is expected in 1987.

PROJECT 2.24: Copper-zinc deposits, Snow Lake area

INVESTIGATOR: M.A.F. Fedikow

OBJECTIVES:

To ascertain stratigraphic and structural controls of rock sequences hosting known copper-zinc deposits in the Snow Lake area.

To establish the nature and genesis of those copper-zinc deposits and investigate possible exploration methodology for detecting previously unknown copper-zinc mineralization.

PROGRESS:

Mineral deposit documentation is complete in the Snow Lake area of the Flin Flon-Snow Lake greenstone belt.

PRODUCTS:

Mineral deposit maps for the Snow Lake area are in preparation.

Detailed geological mapping and geochemical sampling have been undertaken in the vicinity of most of the occurrences examined to date. An extensive geochemical data base is being developed for these occurrences and includes assay and geochemical analyses from the mineralized zones and host rock sequences. A regional rock geochemical sampling program will be continued and is designed to determine background geochemical concentrations of a wide range of trace elements in major lithologies of the area.

Preliminary findings have been described in the 1984, 1985 and 1986 Reports of Field Activities. A mineral deposit open file is available for inspection and contains the location of each mineral occurrence plotted on an air photo. Accompanying detailed sketch maps and assay results complete the file to date.

FOLLOW-UP AND IMPLICATIONS:

The 1986 field season has resulted in the completion of the examination of mineral occurrences in the Snow Lake area. More detailed examinations of mineral occurrences are expected to continue for several years in an attempt to define metallotects. As these detailed projects evolve, findings will be released in the form of open file reports, including any detailed mapping, so that mining and exploration companies will have quick access to relevant, up-to-date information.

PROJECT 2.30: Mineral deposit geology - Flin Flon

INVESTIGATORS: G.H. Gale, G. Ostry

OBJECTIVES:

To establish the geological setting and origin of selected mineral occurrences in the Flin Flon area.

PROGRESS:

Detailed mapping was undertaken at the Baker Patton deposit.

PRODUCTS:

A preliminary report was presented in the 1986 Report of Field Activities.

FOLLOW-UP AND IMPLICATIONS:

Detailed mapping will be extended; geochemical surveys will be completed with eventual inclusion in an open file report.

PROJECT 2.31: Metallogeny of felsic intrusive rocks

INVESTIGATORS: N.M. Halden, G.H. Gale

OBJECTIVES:

To establish the metallogeny and genesis of felsic intrusive rocks in the Flin Flon-Snow Lake greenstone belt, Manitoba and to establish a geochemical data base for felsic intrusive rocks in the Flin Flon-Snow Lake greenstone belt.

PROGRESS:

Samples have been prepared for analysis using fused beads and powdered briquettes. Analyses for major elements are completed.

PRODUCTS:

350 major element analyses. Report in 1986 Report of Field Activities.

FOLLOW-UP AND IMPLICATIONS:

A preliminary report synthesizing the geochemical data will be prepared in early 1987. A two-week field season will be undertaken by N.M. Halden to evaluate further studies. M.Sc. studies have been postponed to a later date.

PROJECT 5.6: Sub-Paleozoic compilation - Project Cormorant

INVESTIGATORS: I. Hosain, W.D. McRitchie, W. Weber, in cooperation with the Geological Survey of Canada

OBJECTIVES:

To collate and compile geological and mineral exploration data from Precambrian basement covered by younger Paleozoic limestones, south of Flin Flon and Snow Lake.

PROGRESS:

Report and compilation maps by Taiga Consultants were evaluated and formed the basis for additional drill hole targets for MGSB activities (MGSB Project 1.7) and drilling funded by GSC. Sophisticated interpretation of aeromagnetic data and U-Pb geochronology program of granitic rocks cored for MGSB Project 1.7 were initiated, both to be executed by GSC. Namew Lake ultramafics are being geochemically investigated.

PRODUCTS:

Drill hole data and interpretation in Report of Field Activities 1986.

FOLLOW-UP AND IMPLICATIONS:

- Continuation of MGSB scout drilling and contract drilling financed by the GSC.
- Geochemical investigations.
- U-Pb geochronology of selected drill core.
- Petrographic analyses of mafic-ultramafic core.
- Massaging of geophysical data.
- Relogging of critical company drill core.

Activities will generate a comprehensive data base for compilation of the basement geology.

GEOLOGICAL SURVEY OF CANADA**PROJECT C.1.1.1: Mineralized alteration zones, southern Churchill Province**

INVESTIGATORS: E. Froese (LCSD)
E. Zaleski (U. of M.)

OBJECTIVES:

To investigate and describe the mineralogy of hydrothermal alteration zones associated with metamorphosed massive sulphide deposits.

PROGRESS:

E. Zaleski continued field work on the Linda deposit in the Snow Lake area. She completed core logging and mapped an area, 5 x 2 km, at a scale of 1:5000. Particular attention was paid to the stratigraphic and structural relation of the deposit to the enclosing rocks.

E. Froese continued an investigation of the Wolverton Lake alteration zone and, as part of a cooperative project with M. Fedikow, examined thin sections from the Cook Lake alteration zone.

M. Leroux is continuing a Master's level study (U. of Manitoba - F.C. Hawthorne) of the mineralogy of cordierite-anthophyllite rocks in the Sherridon area.

PRODUCTS:

E. Zaleski has presented posters at the GSC and Manitoba Open Houses, as well as submitting a paper for publication in Current Research, GSC Paper 87-1B.

FOLLOW-UP AND IMPLICATIONS:

Understanding of the mineralogical composition of these alteration zones will allow explorationists to possibly segregate base metal from barren massive sulphide bodies, as well as define the position of an alteration zone in relation to the associated sulphide body.

End products will include doctoral and master's theses as well as papers in government and outside journals.

PROJECTS C.1.2.1: Sub-Paleozoic compilation/core drilling

INVESTIGATORS: T.M. Gordon (LCSD)
B.B. Blair (LCSD)
L.J. Kornik (LCSD)

OBJECTIVES:

To investigate, map and interpret Precambrian geology beneath Paleozoic cover rocks adjacent to the edge of the Shield. Involves a geological compilation of sub-Paleozoic basement geology, modelling of geophysical anomalies, correlation with exposed surface geology, geological synthesis of basement geology, selection of targets for drilling, logging of already available and new drill core and production of final synthesis. Core samples will be used for U-Pb zircon age dating. GSC will be particularly responsible for drill target selection and drilling in areas not accessible from roads. All of this with close consultation and cooperation between GSC and MGSB.

PROGRESS:

A preliminary compilation of data available on the sub-Paleozoic geology was received from Taiga Consultants. This included a dBase III data base of drill hole locations with abbreviated logs, a set of 1:50 000 scale maps of drill hole locations, preliminary geological and geophysical interpretation, and 1:20 000 maps of drill hole locations, geology and Phanerozoic isopach. The 1:250 000 scale geology map was released as GSC Open File 1381.

In November 1986 Bruce Blair began management of a drill contract in which up to 24 holes will be drilled off-road by the spring of 1987. Drilling will test geophysical targets selected by GSC/MGSB.

PRODUCTS:

Poster display at the Manitoba Mines Branch and at CIM Branch Meeting, Winnipeg, April 1986.

1:250 000 geology map as GSC Open File 1381.

Submission of abstract for GAC/MAC '87, Saskatoon:

Blair, B.B., Kornik, L.J. and Gordon, T.M.

1987: Sub-Paleozoic geology of the Cormorant Lake map area: interpretation of airborne gradiometer surveys and drill core data.

FOLLOW-UP AND IMPLICATIONS:

Work will continue on relogging archived drill core at The Pas, as well as fill-in drilling next winter. Les Kornik will provide interpretation of the geophysical data. This work will allow for the definition of major lineaments as well as environments favourable for base metal and PGM mineralization.

PROJECT C.2.1.1: Flin Flon-Snow Lake metallogeny

INVESTIGATORS: J.M. Franklin (MRD)
A.G. Galley (MRD)

OBJECTIVES:

To obtain an understanding of controls in gold and massive sulphide deposits; alteration, structure, petrology and isotope geochemistry in relation to genesis will be emphasized. The project represents a continuation of existing studies and will involve: regional setting of mineralization in light of the tectonic history of the area; geochemical and isotopic studies; metallogenic comparisons between deposits in the Churchill Province and similar types of Archean terranes. The Flin Flon-Snow Lake area is well known for its massive sulphide deposits, and potential for further discoveries exists. Gold deposits in the area have received only brief investigations in the last 30 years.

PROGRESS:

In the Snow Lake area a six person party headed by A.G. Galley completed mapping of volcanic stratigraphy, structure, and gold occurrence locations. Drill core was logged and sampled from the Nor-Acme and Goldfields deposits plus the Bounter and Caper showings. Detailed mapping was completed on selected areas and outcrops prepared for inclusion in the GAC/MAC Flin Flon-Snow Lake 1987 field trip.

There is a spatial correlation between gold deposits and splay faults in the hanging wall to the McLeod Road Thrust Fault. Gold was emplaced in these structures after peak metamorphism. Alteration associated with the gold-bearing structures is recognized and may become a useful exploration tool.

Roger Skirrow has completed mapping and sampling of the alteration zones within the deep footwall rocks to the Chisel Lake volcanogenic massive sulphide deposit for his M.Sc. thesis. A wide zone of quartz-epidote alteration is contained within a mafic heterolithic debris flow in the Edwards Lake area. As this unit is followed along strike towards Chisel Lake, alteration changes to Fe-Mg enrichment. This suggests a genetic spatial relationship between distal and proximal alterations in the footwall to the Chisel Mine. This has a wide range of implications for grassroots massive sulphide exploration. Skirrow will lead a GAC/MAC 1987 field trip through his thesis area in May.

In the Elbow Lake area, a six person party under A.G. Galley and D.E. Ames initiated 1:20 000 scale mapping of the supracrustal rocks in the region, with the objective of placing more than 12 gold occurrences in the area within the stratigraphic and structural history of the area. The program was successful in delineating major stratigraphic units and large faults that control the gold mineralization. The documentation of a major zone of deformation is important in understanding the process of gold deposition; large structures such as the Elbow Lake Fault zone are historically important in the Superior Province because of their spatial relationship to major gold deposits.

PRODUCTS:

Posters on Snow Lake-Wekusko Lake gold metallogeny presented at Gold '86 conference and at Manitoba Meeting with Industry. Poster on Southern Churchill gold metallogeny presented at GSC Open House.

Poster on Alteration in the Chisel Lake region by R. Skirrow at the Manitoba Meeting with Industry.

Completion of M.Sc. thesis by R. Skirrow on silicification of volcanic rocks near the Chisel Mine, Snow Lake.

Galley and Skirrow will assist in the GAC/MAC '87 field trip to the Flin Flon-Snow Lake belt.

FOLLOW-UP AND IMPLICATIONS:

Gold deposit field studies will be completed in the Snow Lake area, while kinematic field studies on faults related to gold mineralization will be completed in the Herb Lake area. At Elbow Lake 1:20 000 scale field studies will be completed and more detailed work on gold occurrences will be undertaken. Open file reports on Snow Lake and Elbow Lake will be completed by the late fall of 1987.

Enough data have now been collected and examined from which a series of gold deposit models are evolving which explorationists may use to narrow down grassroots programs for gold to specific regions within the Proterozoic rocks of the Southern Churchill Province.

PROJECT C.2.2.1: Flin Flon-Snow Lake mafic-ultramafic studies

INVESTIGATOR: J.M. Duke (MRD)

OBJECTIVES:

To characterize mafic-ultramafic bodies in the Flin Flon-Snow Lake area with emphasis on their potential to host magmatic sulphide (Ni-Cu-PGE) and oxide (Cr-Ti-V) mineralization. The first phase will involve mapping, sampling and petrological characterization of the major bodies in the belt over a two year period. The second phase will include more detailed studies of selected bodies and mineralization. The first phase is being undertaken under contract to the University of Manitoba.

PROGRESS:

Field studies have been completed by Jeff Young and Lorne Ayres (University of Manitoba), with final reports documenting the seven mafic-ultramafic bodies investigated to be submitted early in 1987. Recognition of repetitive layering in the Reed Lake Layered Complex has led to exploration activity for possible concentrations of platinum group elements.

PRODUCTS:

Annual internal reports have been submitted to the GSC.

FOLLOW-UP AND IMPLICATIONS:

GSC personnel will analyze samples from the Reed Lake Complex, Jackfish Complex, and Chisel Lake Complex for PGE content. Recognition of repetitive layering plus PGE analyses of intrusions with the most potential for precious metal mineralization will allow explorationists to refine their search areas and techniques for this deposit type.

PROJECT C.2.2.2: Mafic-ultramafic studies, Northern Churchill

INVESTIGATOR: L.J. Hulbert (MRD)

OBJECTIVES

To characterize mafic-ultramafic bodies with emphasis on their potential for magmatic sulphide (Ni-Cu-PGE) and oxide (Cr-Ti-V) deposits. One

component will provide data on the platinum metal concentrations in known mineralization; another will document the character of some of the mineralized mafic-ultramafic bodies.

PROGRESS:

During 1986 the following localities were investigated: Lynn Lake, Carr Lake, Tow Lake, Larsen Lake, Black Trout Lake, Snow Lake, Granville Lake and the Agassiz Au-deposit. Four main conclusions can be stated: the mafic-ultramafic intrusions in the Lynn Lake greenstone belt are poor hosts for PGE's; three different generations of mafic intrusive events took place in the area; the Agassiz Au-deposit ores, of boninite affinity(?), do not contain Pd or Pt at levels exceeding 9 and 15 ppb, respectively; and significant concentrations of Fe-Ti-V spinels and phosphates occur in the Tow Lake intrusion (a feature not previously recognized).

PRODUCTS:

Larry has presented 10 talks on aspects of Ni-Cu-PGE mineralization with references to Manitoba occurrences. Papers including Manitoba occurrences have been published as abstracts in several publications.

FOLLOW-UP AND IMPLICATIONS:

The field component of this project is essentially complete. Analysis and project write-up will continue through 1987/88. Results of this project will not only allow exploration companies to better target their activities on specific intrusion types for PGE mineralization, but has also increased knowledge on Cr-Ti-V type deposits thereby potentially broadening Manitoba's mineral base.

PROJECT C.3.1.1: Aeromagnetic gradiometer surveys

INVESTIGATORS: P.J. Hood (EP)
E.E. Ready (EP)

OBJECTIVES:

To provide complete high resolution aeromagnetic gradiometer maps and VLF EM profile data or INPUT data of selected areas. It is anticipated that most or all of the areas proposed by Manitoba will be surveyed during the program but some adjustment of boundaries will be needed. The surveys will be carried out by contractors. (Revised Feb. 6, 1987).

PROGRESS:

1. Aeromagnetic gradiometer and VLF EM surveys - Sherridon, Elbow Lake, Moose Lake (north), Root Lake, Flin Flon area 1985/86.

Contractor: Kenting Earth Sciences Ltd.

Contract awarded September 24, 1985: data acquisition completed in February 1986.

Compilation by contractor and monitoring by the Technical Inspectors ongoing to present time.

OUTPUTS:

19 total field contour maps at 1:20 000

19 vertical gradient contour maps at 1:20 000

9 total field colour interval maps at 1:50 000 with VLF
9 vertical gradient colour interval maps at 1:50 000 with VLF
Final deliveries: April 1987

2. Aeromagnetic gradiometer and VLF EM Surveys - Rice Lake (52M/4, 52L/13NE), Hargrave River (63J/6N, 7NW, 10W, 11), Moose Lake (63K/1, 2E). 1986/87.

Contractor: Kenting Earth Sciences Ltd.

Contract awarded August 26, 1986: data acquisition completed early
October 1986.

Geophysical data in editing process.

OUTPUTS:

20 total field contour maps at 1:20 000

20 vertical gradient contour maps at 1:20 000

8 total field colour interval maps at 1:50 000

8 vertical gradient colour interval maps at 1:50 000

Final deliveries: December 1, 1987.

FOLLOW-UP AND IMPLICATIONS:

A decision has been made to change the direction of the geophysical program from high resolution gradiometer to INPUT surveys. The province has decided that it is satisfied with gradiometer coverage to date.

INPUT will be flown over parts of 64C/13 and 14 in an effort to discover the western extension of the Lynn Lake gold belt which has high potential for further discoveries of gold mineralization.

PROJECT C.4.1.2: Glacial prospecting

INVESTIGATORS: R.N.W. DiLabio (TSD)
C.A. Kaszycki (TSD)

OBJECTIVES:

To provide base line information regarding regional ice flow patterns, dispersal directions, and drift composition in the Lynn Lake - Leaf Rapids - Flin Flon region (NTS 64B, C, F, G; 63N and O), as an aid to mineral exploration in northwest Manitoba. This involves regional mapping of surficial deposits at 1:100 000 scale, systematic till sampling of the same areas to evaluate drift composition, and mapping both large- and small-scale patterns of glacial dispersal. Regional sampling will be supplemented by more detailed studies in areas of potential economic interest identified on the basis of: anomalous till geochemistry, local bedrock geology, aeromagnetic and airborne anomalies, and modern lake sediment geochemistry. Specific objectives are: 1) to define the influence of local bedrock lithologies, particularly those comprising greenstone belts, on till composition and to determine if till lithology can be used to extend bedrock mapping in areas of extensive drift cover; 2) to evaluate the applicability of surficial geochemistry surveys, including modern lake sediment geochemistry, in terrains dominated by various types of surficial deposits; 3) to develop till sampling and analytical strategies for drift prospecting in areas of boreal forest where access is limited, clay cover is problematic, and drift composition is dominated by exotic debris (e.g. Paleozoic carbonate) thereby suppressing local bedrock signature.

PROGRESS:

- a) A paper summarizing the Quaternary geology and till geochemistry of the Lynn Lake-Leaf Rapids area was published in Current Research. Till geochemical data for NTS 64F were published as GSC Open File 1205.
- b) Kaszycki, DiLabio and assistants carried out helicopter-supported field work over a 12-week period from June 1 to August 31. Reconnaissance till sampling and field checking were completed for NTS 64B and 63N. Field work in 63K (N 1/2) and 63-0 (W 1/2) was not completed because of a shortage of field time and funding. Preparation and geochemical analysis of till samples are being carried out. Airphoto interpretation was completed for NTS 64B and 64G.
- c) A previously unmapped ultramafic body was found at Osik Lake (NTS 63-0) using classic glacial dispersal and boulder tracing methods. Samples of this rock contain significant amounts of chromium and nickel but low amounts of gold and platinum group elements. The dispersal train from this body is being defined using till geochemistry.
- d) Under a contract to J. Elson (McGill Univ.), a graduate student completed detailed sampling to identify the source of a large arsenic anomaly in till in the Wheatcroft Lake area (NTS 64C and N). This anomaly appears to be a dispersal train derived from several small base metal and gold occurrences.
- e) Gold analyses were completed on archived samples from parts of 64G, 64C, and 64B.

FOLLOW-UP AND IMPLICATIONS:

1. Detailed sampling in the Leaf Rapids-Ruttan-South Bay area to determine if till lithology can be used to map drift-covered extensions of the Ruttan greenstone belt.
2. Detailed sampling in the Rusty Lake area near Ruttan to identify the extent of sulphide mineralization in the area.
3. RWAC spot sampling of till east of Baldock Lake to check aeromagnetic anomalies suspected to be ultramafic intrusives similar to those found in 1986 at Osik Lake and Baldock Lake through boulder tracing and till sampling.
4. Follow-up till sampling in the Kississing Lake map sheet (63N) in areas of anomalous till geochemistry.
5. Backhoe sampling of gold-bearing Lake Agassiz beach sands and underlying till at Manigotagan to identify the sedimentologic controls on these placers.
6. Contract airphoto interpretation to complete surficial geology mapping of NTS 63-0 and 63N.
7. Study of till composition and genesis of lithologically banded till in the Gillam area to identify glaciological controls on the compositional variability in exotic tills.

PRODUCTS:

- Open file release: 1) till geochemical data 64B, 63N, 63-0 (NW 1/4);
2) surficial geology maps 64B, 63N.

Papers - Current Research, 1987 Part B.

- 1) Osik Lake Dispersal Train
- 2) Wheatcroft Lake Dispersal Train

Trains - Till geochemistry symposia at CIM, Toronto, May 1987 and INQUA, Ottawa, August 1987.

PROJECT C.5.1.1: Quaternary Atlas Compilation north of 52° latitude

INVESTIGATORS: R.N.W. DiLabio (TSD)
C.A. Kazsycki (TSD)
M. Clark (TSD)

OBJECTIVES:

To produce an atlas showing (1) surficial geology, (b) till geochemistry and (c) granular material resources. Coverage to start in northeast corner of area and proceed clockwise using data from Dredge, Kaszycki, Klassen, DiLabio (GSC) and Nielsen (MDEM). 'Gaps' in coverage to be filled in by airphoto interpretation and a limited amount of field checking. Legends, other specs, style of presentation to be determined by same personnel.

PROGRESS:

- a) Field checking of airphoto interpretation of NTS 53E, 53N and 63H was completed.
- b) Contracted-out airphoto interpretation of 63A(1/2) and 53D(1/2) was completed.
- c) Airphoto interpretation of 63C was completed.
- d) Cartography for colour publications of 53K and 53L is in progress.
- e) Evaluation of Landsat imagery for surficial mapping is in progress.

FOLLOW-UP AND IMPLICATIONS:

- 1. One month of field work in The Pas area will be done to field check airphoto interpretation of surficial geology of NTS 63C, F, and K. Work will be done in cooperation with E. Nielsen and H. Groom to avoid duplication of effort.
- 2. Contracted-out airphoto interpretation of surficial geology of NTS 53-0, 54A, and 54B.
- 3. Contracted-out cartography of up to 8 maps.
- 4. Continuation of an evaluation of remotely-sensed data for mapping surficial geology.

DISTRICT III: SOUTHEAST MANITOBA

Summary and Project listing:

An additional 30 mineral occurrences were examined in the Rice Lake region bringing documentation in this region near to completion. Particular attention was given to gold associated with epigenetic sulphide mineralization at the 'Tut' occurrence, gold-bearing quartz veins in a 2 km long stratigraphic unit at Lily Lake, and gold within arkosic rocks of the Edmunds Lake Formation.

Samples from the Dumbarton Mine/Maskwa West Pit, the Wards occurrence, New Manitoba Mine, Hititrite and Mayville occurrences, English Lake and the Bird River Complex, returned only sub-economic and/or marginally detectable Pt and Pd values, as did 50 samples from the Neepawa mafic-ultramafic complex.

Industrial minerals activities continued evaluation of potential sites for dimension stone in southeast Manitoba as well as collection of additional samples of kaolin on Black Island.

Ground truthing of peat bogs near Grindstone Point was conducted in cooperation with the Manitoba Centre for Remote Sensing and the University of Manitoba Department of Botany, as part of an ongoing program to evaluate the use of remote sensing as a means of conducting a rapid and economic regional inventory of sphagnum peat bogs.

Detailed mapping near Stormy Lake and the Manigotagan River refined the structure and stratigraphy of the Wadhope-Gunnar anticlinorium as well as the transition from volcanism to sedimentation in the Rice Lake Group. Several new factors of economic significance were unveiled including definition of subaerial volcanics, location of volcanic vents and a structural control of mineralization in gabbroic rocks.

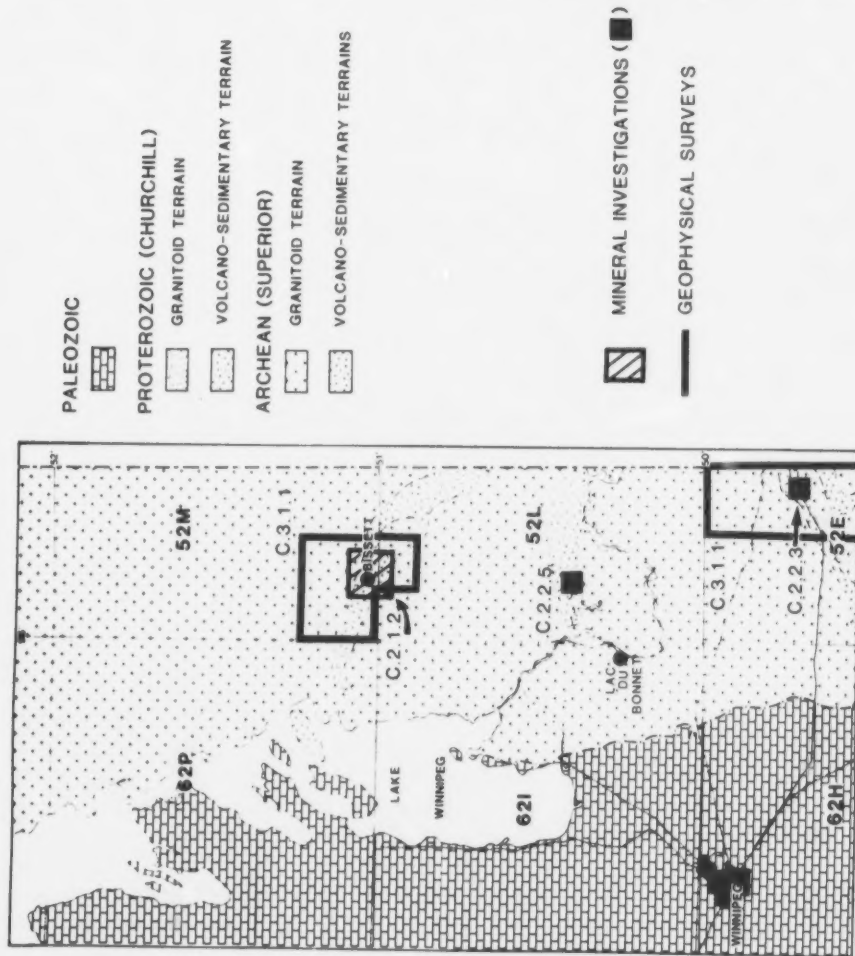
Backhoe sampling in the Manigotagan area confirmed the presence of trace gold in reworked littoral glacial sands, and a potential for placer deposits.

An evaluation of geophysical and subsurface drill hole information has led to an enhanced interpretation of the Precambrian geology beneath Phanerozoic cover rocks in the Whitemouth and Black Island areas.

GSC

In the Bissett area, gradiometer surveys were flown over NTS 52M/4 and 52L/13 NE, and the GSC continued regional structural and alteration studies, and mine-scale alteration and fluid inclusion studies in the area centred on the San Antonio Gold Mine. The University of Manitoba continued its work on the mine-scale structures controlling the gold mineralization.

On the Chrome Property (in the Bird River layered intrusion) mapping of the chromite layers, at a 1:100 scale, was used extensively in the Sector B evaluation of this ore zone, and in Lakefield Research's beneficiation studies.



GEOLOGICAL SURVEY OF CANADA

C.2.1.2 Bissett Structural Studies

Officers: K. Poulsen (GSC) (August)

D.E. Ames (GSC), A. Galley (GSC) (May)

Base: Bissett

C.2.2.3 Mafic-Ultramafic Rocks: Falcon Lake Stock

Officer: W. Brisbin (U of M), N. Halden (U of M)

Base: U of M Field Station

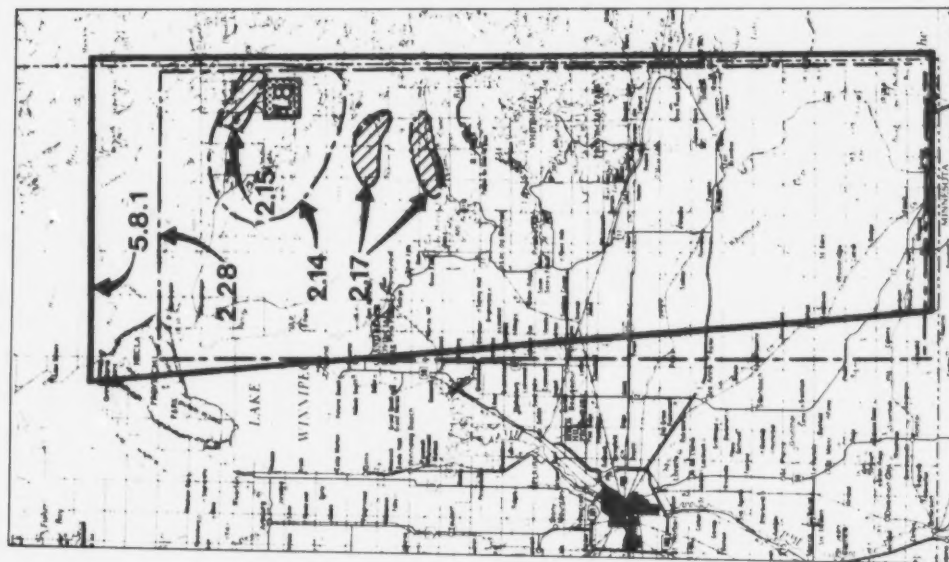
C.2.2.5 Mafic-Ultramafic Rocks: Bird River Sill

Officer: J. Scoates (GSC), B. Williamson (GSC)

Base: Talltimber Lodge, Lac DuBonnet

C.3.1.1 Gradiometer Survey: Whitemouth, Rice Lake

Figure 6: Location of Sector A projects (1986) - DISTRICT III: SOUTHEAST MANITOBA



MANITOBA GEOLOGICAL SERVICES BRANCH

- 1.8 Rice Lake geological mapping
- 2.14 Deposit documentation Rice Lake area
- 2.15 Wallace Lake gold deposits
- 2.17 Platinum element evaluation
- 2.28 Dimension stone, resource assessment
- 5.8.1 Geological compilation

Farther south, several students from the University of Manitoba engaged in studies on the Falcon Lake Stock including a thesis on the internal structure of the plug as well as studies of the petrography and gold mineralization, the latter centred on the Sunbeam-Kirkland Mine.

MANITOBA GEOLOGICAL SERVICES BRANCH

PROJECT 1.8: Rice Lake geological mapping

INVESTIGATORS: W. Weber, D. Seneshen*, and D. Owens*

OBJECTIVES:

To undertake lithologic and structural mapping of geological environments with known or suspected potential for gold mineralization to improve targeting criteria for exploration.

PROGRESS:

Mapping of the newly burnt-over area between Beresford Lake, Long Lake and Grassy Rice Bay, started in 1985, was continued in 1986. Structural and stratigraphic parameters, in part critical for gold deposition, were delineated in further detail.

PRODUCTS:

- Two preliminary maps (1:10 000).
- Report in Report of Field Activities 1986.
- One M.Sc. thesis (D.Seneshen).

FOLLOW-UP:

One M.Sc. thesis will investigate the surf-zone depositional environment of the Manigotagan River Formation.

Further detailed mapping in the Lily Lake area.

IMPLICATIONS:

The results have been and will be of assistance to gold exploration activities, specifically to Esso Resources presently active in the area.

* seasonal investigators

PROJECT 2.14: Mineral occurrence documentation - Rice Lake greenstone belt

INVESTIGATORS: P. Theyer

OBJECTIVES:

This program will provide an inventory of all known mineral occurrences of the Rice Lake greenstone belt. This inventory will include data on the location, geology and mineral content of these occurrences. The information will provide an updated data base for the exploration of gold and other commodities in this area.

PROGRESS:

Investigation and documentation of approximately 130 mineral

occurrences have been completed. Two of these occurrences (Tut and Lily Lake) warranted intensive and detailed studies because of high levels of mineralization.

PRODUCTS:

Preliminary reports on the progress of this program were published in the Reports of Field Activities 1984, 1985, and 1986 (GS-24, 1984; GS-28, 1985; GS-24, 1986).

FOLLOW-UP AND IMPLICATIONS:

Mineral deposit documentation will be completed during the 1987 field season. Due to their geological setting and mineralization, the deposits will be examined in detail. A final report will be issued after completion of this phase of the program.

PROJECT 2.15: Genesis of the Gatlan and related gold occurrences, Wallace Lake area

INVESTIGATORS: P. Theyer and R. Gaba (seasonal assistant)

OBJECTIVES:

The investigation of the Gatlan and related gold occurrences in the Wallace Lake area will provide information concerning the geology of the deposits, metal sources and concentrating mechanisms of the numerous smaller gold occurrences in this area. This study will provide guidelines for exploration designed to locate repetitions of this style of mineralization in the area.

PROGRESS:

Detailed investigations and sampling of the iron formations between Wallace Lake and Siderock Lake failed to identify the existence of significant gold concentrations or zones of sulphidization additional to those recognized in 1985. Field activities were cancelled in June 1986.

PRODUCTS:

The results of this work are published in Report of Field Activities 1986 (GS-24).

FOLLOW-UP AND IMPLICATIONS:

The Gatlan gold occurrence appears to be controlled by specific stratigraphic and tectonic components. The search for other areas with similar tectonostratigraphic features resulted in the discovery of previously unknown disseminated sulphides and free gold in iron formation between Wallace Lake and Siderock Lake. Detailed mapping and sampling of this area is expected to provide information on the economic potential of these rocks.

PROJECT 2.17: Platinum group element potential, Bird River area

INVESTIGATOR: P. Theyer

OBJECTIVES:

The objectives of this program are: (a) to establish the existence of

platinum group elements in the Bird River Complex of southeastern Manitoba; and (b) to investigate the geological controls and geographical extent of platinum group element mineralization in this complex.

PROGRESS:

Detailed sampling and mapping programs identifying highly anomalous platinum group element concentrations in several mineral occurrences on the northern flank of the Bird River Complex.

PRODUCTS:

Progress made in 1986 is described in GS-25, Report of Field Activities 1986.

FOLLOW-UP AND IMPLICATIONS:

The results of this program established the existence of significant platinum group element concentrations in both the ultramafic and the mafic rocks of the Bird River Complex. Current investigations of the petrology, mineralogy and the distribution of platinum group elements in the ultramafic part of the Chrome property are expected to provide guidelines for a systematic search of platinum group elements in this igneous complex.

PROJECT 2.28: Dimension stone resource assessment

INVESTIGATOR: B.E. Schmidtke

OBJECTIVES:

The purpose of this program is to evaluate the nature and extent of Manitoba's dimension and ornamental stone resources and to provide an inventory of materials with a potential for future development.

PROGRESS:

Road accessible outcrops of the Lac du Bonnet Batholith with an average joint spacing greater than 2 m were mapped at a scale of 1:200. Three sites identified in the 1985 survey were drilled to determine horizontal joint spacing and the homogeneity of colour and texture at depth.

PRODUCTS:

A preliminary report (GS-27) in Report of Field Activities 1986 describes the findings in southeast Manitoba. Occurrence files of sites documented in the 1985 survey have been compiled.

A brochure on 'Manitoba Stone' that highlights several of the potential sites selected for drilling and mapping was completed and is now available to the public; the accompanying slab sets are being selectively distributed.

FOLLOW-UP AND IMPLICATIONS:

Geological mapping at 1:200 will continue in the Whiteshell and Nopiming Parks areas. Large samples will be taken for the production of polished display slabs. Two potential sites will be drilled in 1987. Strength tests will be conducted on drill core from the 1986 and 1987 drilling and the data incorporated into a Geological Engineering undergraduate thesis.

PROJECT 5.8.1 1:250 000 geological compilation, Southeast Manitoba

INVESTIGATORS: W. Weber, C. McGregor, D. Kowerchuk

OBJECTIVES:

To synthesize and compile all geological data, including drill hole information of sub-Quaternary basement of southeast Manitoba.

PROGRESS:

Sub-Quaternary Precambrian geology of Whitemouth and Black Island areas was compiled from existing drill hole information including examination of drill core and chips, and interpretation of aeromagnetic maps.

Bedrock geology of 52E was compiled.

PRODUCTS:

Reports and maps of subsurface geology of Whitemouth and Black Island areas (Reports GS-28 and 29) in Report of Field Activities 1986.

FOLLOW-UP AND IMPLICATIONS:

NTS sheets 52E and 52L will be published as Preliminary compilation maps and NTS 62H and 62I will be compiled.

This will provide a much needed updated compilation data base for gold and platinum exploration in southeastern Manitoba.

GEOLOGICAL SURVEY OF CANADA

PROJECT C.2.1.2: Bissett structural studies

INVESTIGATORS: K. H. Poulsen (MRD)
 D.E. Ames (MRD)

OBJECTIVES:

To examine regional and local features directly related to gold ore in the Rice Lake-Beresford Lake greenstone belt within a map area, approximately 100 km², centred on Rice Lake to assess: a) the relationship between gold-bearing structures and regional increments of deformation; b) recurring stratigraphic affiliations as a guide to ore; c) the role of alteration (principally carbonatization) in the ore-forming process and its applicability as a guide to ore.

PROGRESS:

Surface mapping continued in the area south of Rice Lake by D.E. Ames and A.G. Galley, while K.H. Poulsen continued detailed mapping of the Sannorm property east of the San Antonio Mine.

D.E. Ames and K.H. Poulsen continued structural and alteration studies underground at the San Antonio Mine with full cooperation of Inco geologists. Doreen Ames is continuing an M.Sc. thesis study of alteration associated with gold mineralization at the San Antonio and Sannorm.

Sabastian Lau and W.C. Brisbin are continuing a structural study of the vein systems at the San Antonio Mine, with Sabastian continuing his graduate work on this topic.

Studies to date have shown that the host of the San Antonio Mine is a layered, synvolcanic mafic intrusion, with extensive zones of carbonatization associated with gold mineralization. Surface mapping has defined major faults in the Rice Lake area that may be temporally related to gold mineralization.

PRODUCTS:

Posters presented at the Manitoba Meeting with Industry, November 1986, and Gold '86 symposium, Toronto, September 1986. Paper published in GSC Current Research 87-1B.

FOLLOW-UP AND IMPLICATIONS:

1. D. Ames and assistant will map the "mine sequence" extending through the north side of Rice Lake and beyond the Sannorm deposit to the northeast at 1:50 000 scale. Sampling to establish the patterns of alteration in basaltic rocks will be emphasized. (4 weeks)
2. A. Galley and assistant will extend the level of 1:10 000 scale mapping in the area south and east of Rice Lake. (2 weeks)
3. K.H. Poulsen and assistant will undertake structural mapping along the Wanipigow Fault and conduct brief evaluations of the local structural geology around selected deposits in Rice Lake-Beresford Lake area including: i) Gunnar, ii) Ogama-Rockland, iii) Central Manitoba, and iv) Oro Grande. F. Robert (GSC) will participate in this activity. (3 weeks)
4. W.C. Brisbin and S. Lau (U. of Manitoba, contract) will continue a structural analysis of San Antonio Mine.
5. G. Skippen and colleagues (Carleton U., contract) will assess carbonate alteration adjacent to quartz veins within Rice Lake map area and compare with composition of fluid inclusions in vein materials.
6. Underground studies of structure, alteration, stratigraphy at San Antonio Mine will continue subject to access.

PROJECT C.2.2.3: Mafic-ultramafic studies, Falcon Lake Stock

INVESTIGATORS: R.F.J. Scoates (MRD)
W.C. Brisbin (U. of M.)

OBJECTIVES:

To investigate the petrology, tectonic setting and precious metal mineralization in the Falcon Lake Stock. The stock hosts significant gold mineralization and an unconfirmed occurrence of platinum group elements. An investigation of the primary layered structures, modally graded layers, and characterization of the petrotectonic setting is to be carried out under contract by W.C. Brisbin (U. of M.). The study of the mineralization will also be undertaken as a Master's project.

PROGRESS

Three subprojects are now underway:

1. A final report on the internal structural fabric of the complex will be prepared by W. Mandziuk (U. of M.) on or before June 30, 1986.
2. The study of Au mineralization by J. Fingler (U. of M.) will continue and focus on completing the detailed mapping and sampling of occurrences in the complex.
3. A new project to document the petrochemistry of the Falcon Lake Igneous Complex will be initiated by P. Tirschmann (U. of M.) under the direction of N. Halden.

Subproject 1

Results of the study of the internal fabric of Falcon Lake Stock were incorporated into GAC/MAC 1986 field trip guidebook 13 entitled, "Layered Intrusives of Southeastern Manitoba, and Northwestern Ontario". The final report for this project by W. Mandziuk and W. C. Brisbin (U. of M.), and R.F.J. Scoates (GSC) will be submitted for inclusion in the Canadian Mineralogist, Special Volume on 'Layered Igneous Rocks'.

The results of this study (Subproject 1) illustrate that the original interpretation of the Falcon Lake Stock as a zoned intrusion consisting of two intrusive phases with a simple, passive emplacement history is incorrect. The intrusion, consisting of multiple phases, and the widespread occurrence of layering and other primary structures, suggest an active and complex intrusive history.

Subproject 2

Detailed mapping and sampling of Au occurrences associated with the Falcon Lake Stock initiated in 1985 by J. Fingler (U. of M.) were completed during the 1986 field season. Assays for platinum group elements on 22 samples from mineralized zones indicated that significant concentrations of these elements are not present. Au mineralization is structurally controlled within the stock and in occurrences along the north margin of the stock. Some lithologic control is suggested for some of the latter occurrences.

Subproject 3

Ninety samples were collected from the various units of the Falcon Lake Stock by P. Tirschmann during the 1986 field season. These samples are being prepared for major and trace element analyses, which are currently in progress.

PRODUCTS:

Results of Bill Mandziuk's thesis work have been published as an abstract in the GAC/MAC '86 volume, and in Field Trip Guidebook 13 - Falcon Lake Igneous Complex, GAC/MAC '86. Bill Brisbin presented results from all three subprojects at the Manitoba Meeting with Industry, November 1986.

FOLLOW-UP AND IMPLICATIONS:

The project to document the petrochemistry of the Falcon Lake Complex will continue under the supervision of N.M. Halden (U. of M.). Further sampling of the mafic to felsic intrusive phases will be undertaken and major and trace element analyses will be completed. Mineral chemistry will be pursued using electron microprobe techniques. The petrochemical study will examine the documented complexity of layering using viscosity modelling and will examine the significance of variable oxygen fugacity within the complex in terms of the distribution of known Au mineralization.

PROJECT C2.2.5: Bird River Sill

INVESTIGATORS: R.F.J. Scoates (MRD)
 J.M. Duke (MRD)
 B.L. Williamson (MRD)

OBJECTIVES:

The project is designed to document the nature, distribution and origin of chromitite layers and subeconomic concentrations of platinum group element-bearing rocks in the Ultramafic Series of the Bird River Sill. Detailed maps, at a variety of scales, will illustrate significant elements of the stratigraphy of the Sill.

PROGRESS:

Geological mapping (1:100 scale) of the Chromitiferous Zone of the Bird River Sill has proceeded westward for approximately 400 m on the Chrome property. Mapping was carried out by B.L. Williamson, P.L. Schwann and J.S. Scoates. Numerous soft sediment-like deformational features have been found as have cross-cutting veins of harrisite. Detailed mapping of the Upper Main Group by J.M. Duke has illustrated the intrusive character of harrisite. The PGE-bearing magmatic sulphide layer has been traced for approximately 800 m along strike by O.R. Eckstrand and R.F.J. Scoates. One day of a three day GAC/MAC 1986 field trip was spent examining the nature of the Ultramafic Series of the Sill. Results of this study were reported in a poster session at GAC/MAC 1986 (Abstracts: Layer disruption in the Ultramafic Series of the Bird River Sill, J.M. Duke, R.F.J. Scoates and B.L. Williamson).

PRODUCTS:

In addition to those mentioned above, talks were presented by Jon Scoates at the GSC Open House and Manitoba Meeting with Industry, plus a poster session at the Manitoba Meeting.

FOLLOW-UP AND IMPLICATIONS:

Geological mapping of the lower part of the Ultramafic Series and of a corridor through the Mafic Series (1:200 scale) will be completed in 1987. In addition, a geological map of the Chrome property (at 1:100 scale) illustrating the distribution of the main elements of the stratigraphy of the intrusion will be completed. Detailed sampling of all Ultramafic Series stratigraphic units will be completed. Field mapping will be carried out by B.L. Williamson, O.R. Eckstrand and R.F.J. Scoates.

Mapping of the Chromitiferous Zone dovetails with CANMET's study of the metallurgical properties of the chrome and the occurrence's economic potential.

DISTRICT IV: THOMPSON

Summary and Project listing:

In north-central Manitoba the industrial minerals evaluation focussed on marble in the Thompson and Pipe open pits, cordierite in the Nelson House region, and alteration minerals at the Ruttan Mine. Samples were also collected from the Manasan quarry which may have a potential as a source for lump silica.

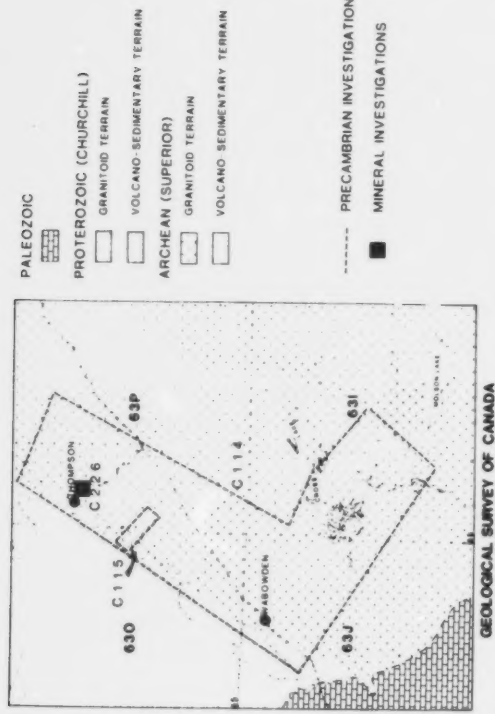
Mapping at a scale of 1:20 000 at Cross Lake extended eastwards to encompass supracrustal sequences at Butterfly Lake as well as all lithologies in the Jenpeg forebay, on Playgreen and Kiskittogisu Lakes. Geologically, the latter area is similar to the Molson Lake batholithic domain comprising an older suite of large batholith complexes with an extended tectonic history. The batholiths predate the Cross Lake supracrustal sequence. Detailed sampling of anorthosites and the associated magnetite/ilmenite deposit on Pipestone Lake was extended westwards to include the "West Channel" anorthosite between the Minago River and Kiskitto Lake. Although no chromitite seams were discovered in this anorthosite, numerous samples were collected for analysis and the initial appraisal suggests mineralogical and textural similarities with the Fiskenaasset complex in Greenland, a generally high anorthite content, as well as some potential for building stone.

In Thompson the recent development of Inco's new open pit mine facilitated detailed documentation of a complete reference section of metasedimentary and mafic-ultramafic rocks, associated with the ore zone, which are only sporadically and incompletely exposed elsewhere. Several factors appear to support an originally Archean age for ultramafics exposed in the pit.

Geochemical, rare earth, and trace element analyses are being undertaken, with cooperation from the University of Manitoba, on mafic and ultramafic rocks along the Thompson belt, and rubidium-strontium determinations were also initiated on felsic intrusions and late deformation zones (pseudotachylite). Together with detailed and regional structural studies funded by the GSC, and the U-Pb geochronology program, these projects represent a concerted attempt to come to grips with the geology of the Churchill-Superior boundary zone, to understand the paragenesis of the nickel deposits, and to evaluate the potential for other types of mineralization.

U-Pb geochronology in the Pikwitonei-Cross Lake region consistently revealed the presence of two distinct events at a number of localities throughout the Pikwitonei Subprovince, although minor differences in these ages were also evident. The older ages all fall within a limited range, i.e. 2719 (Sipiwesk), 2690 (Natawahunan) and 2695 Ma (Cauchon); however, the younger set encompasses a time span of 44 Ma with the youngest age occurring at Cauchon Lake where post-granulite pegmatite has been dated at 2629 Ma.

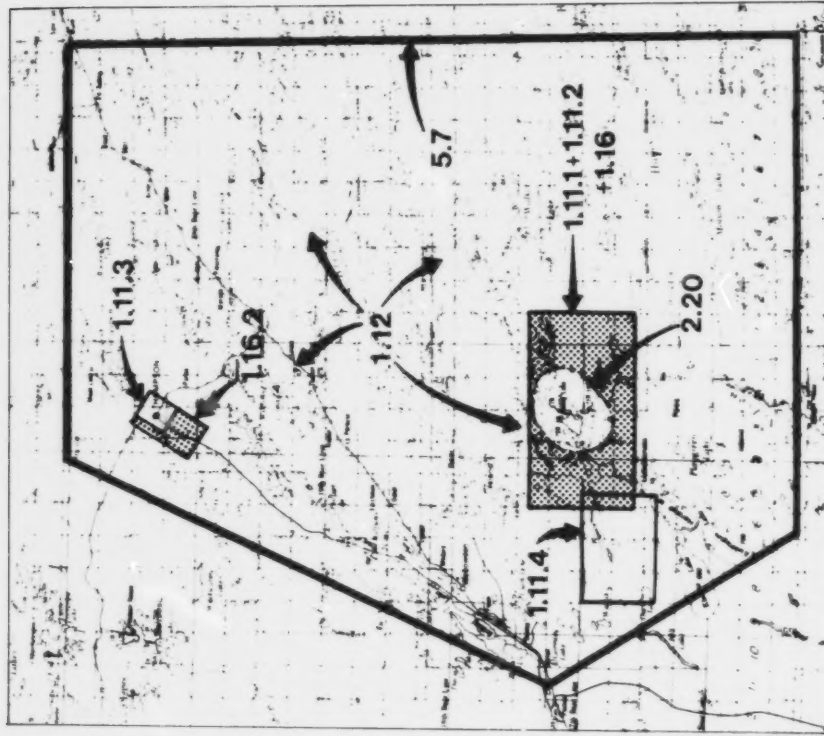
Ages on a Cross Lake-Molson Lake dyke (1884 Ma), a Cuthbert Lake ultramafic dyke (1883 Ma), and the Fox River Sill itself (1884 Ma) suggest that these intrusions are coeval and possibly comagmatic, recording an intrusive event that took place after extrusion of the Lynn Lake arc volcanics (1917 Ma) and slightly prior to intrusions along the Churchill River magmatic zone, and the contemporaneous Ruttan volcanics (1878 Ma).



C1.1.4 U/Pb Geochronology, Northwestern Superior Province
 Officer: Davies (ROM)
 Base: Cross Lake

C.1.1.5 Structural Studies, Thompson Belt
 Officer: F. Feuten (U of T)
 Base: Thompson

C.2.2.6 Thompson Nickel Belt
 Officer: W. Bleeker (U of NB)
 Base: Thompson



MANTOBA GEOLOGICAL SERVICES BRANCH

- 1.11.1 Cross-Pipestone Lake mapping
- 1.11.2 Titanium-vanadium evaluation
- 1.11.3 Thompson Pit mapping
- 1.11.4 Nelson River anorthosite evaluation
- 1.12 Uranium/Lead geochronological sampling
- 1.16 Rubidium-strontium isotope investigations
- 1.16.2 Thompson geochemistry
- 2.20 Rare-element enriched pegmatite evaluation
- 5.7 Thompson-Pikwitonei compilation

Figure 7: Location of Sector A projects (1986) - DISTRICT IV: THOMPSON

GSC

In the Thompson region the U-Pb geochronology program under contract to the Royal Ontario Museum continued, with the area of interest extended to Cross Lake, where mapping by provincial geologists has revealed well exposed rock types amenable to age dating.

A University of Toronto doctoral study investigated the structural setting of the Thompson Belt based on a detailed transect from the Pikwitonei granulite terrain to the Churchill-Superior boundary.

Under the Mineral Investigations sub-program the structure and related geology of the nickel deposits at the Thompson Mine constitutes a Ph.D. study at the University of New Brunswick.

The Terrain Sciences Division supervised a shallow seismic survey in the Thompson area along a line towards Gillam, the objective being to define thick deposits of glacial material that can be drilled during the 1987/88 season in the hope of characterizing the glaciation that has affected much of northern Manitoba.

Several 1:250 000 scale Quaternary geological maps covering a large portion of the Superior Province in Manitoba are also being compiled from airphoto interpretations, together with selected ground truthing.

MANITOBA GEOLOGICAL SERVICES BRANCH

PROJECT 1.11.1 & 1.11.2: Cross Lake, geological mapping and regional evaluation

INVESTIGATORS: M.T. Corkery and H.D.M. Cameron, P.G. Lenton

OBJECTIVES:

The objective of this program is to stimulate and direct mineral exploration in the Cross Lake-Thompson region, to provide a broader mineral base for the Thompson region by establishing an updated geological data base for supracrustal and ultramafic-anorthositic rocks which contain occurrences of strategic, base and precious metals.

PROGRESS:

Geological mapping in the Butterfly Lake area extended the data base for the supracrustal belts 40 km to the east. Mapping at a scale of 1:50 000 carried out in the North Playgreen-Kiskittogisu Lake area enhanced the data base in the granite-gneiss terrain on the south flank of the Cross Lake supracrustal belt. The geochemical data base was increased by complete analysis of 35 rocks as well as partial analysis of 45 previously analyzed specimens. A further 11 samples were analyzed for rare earth elements.

Evaluation of anorthosites was extended to include reconnaissance mapping of the Nelson River anorthosites. Samples were submitted for chemical analysis, including a limited number of sulphide-bearing phases which were analyzed for platinum group elements.

PRODUCTS:

Preliminary map 1986N-1 and a preliminary report GS-30 in the 1986 Report of Field Activities describe the findings in the Butterfly Lake area.

Preliminary report GS-31 documents the findings of anorthosite studies in the Pipestone Lake area.

Preliminary map 1986N-2 and report GS-30 describe the Playgreen-Kiskittogisu and Kiskitto Lakes area.

FOLLOW-UP AND IMPLICATIONS:

A further field season will complete the 1:20 000 scale mapping in the Cross Lake Project area and endeavour to trace the anorthosite-gabbro complex westward to the Nelson River anorthosite complex.

Investigations of supracrustal rocks in the eastern part of the Superior Province will be delayed indefinitely. Instead, mapping for the remainder of the MDA will concentrate on the more accessible areas in the Thompson district. This area appears to be most promising for V, Ti mineralization.

This change is also related to the fact that the rare-element-enriched pegmatites were found to be more restricted than previously anticipated. Therefore, the extension of the Provincial pegmatite evaluation into the easternmost Superior was cancelled and efforts were redirected into the Cross Lake area (see Project description 1.17).

PROJECT 1.11.3: Thompson belt supracrustal rock investigations

INVESTIGATORS: J.J. Macek

OBJECTIVES:

To characterize lithologies of supracrustal rocks in areas of good exposure such as Thompson Pit, Pipe Pit, etc. in support of other investigations in the Thompson belt (Projects 1.16, 1.16.2, C.1.1.4., C.1.1.5, C.2.26) and for compilation purposes.

PROGRESS:

The lithologies of supracrustal rocks of the Thompson Open Pit were documented in detail.

PRODUCTS

Report GS-34 in Report of Field Activities.

FOLLOW-UP AND IMPLICATIONS:

Thompson Open Pit geological documentation will be continued. Pipe Pit and Ospwagan Lake supracrustals will be investigated.

In connection with results from other studies, understanding of tectonic assemblage of Thompson belt, original deposition of supracrustals, and genesis of nickel deposits will be advanced.

PROJECT 1.11.4: Nelson River anorthosite evaluation

INVESTIGATOR: W.D. McRitchie

OBJECTIVES:

To initiate systematic sampling of the West Channel, Minago River and other anorthosite intrusives in the western Cross Lake area. To determine the

field and age relationships of the Nelson River anorthosite complex as well as their geochemical and petrological properties.

PROGRESS:

A two-week field season focussed primarily south of the Minago River, and west of Kiskittogisu Lake on the Nelson River West Channel body. The north, east, west and south contacts of the main West Channel body were accessed by water, and this coverage was augmented by a 3-day, 78 station helicopter sampling of the more remote and poorly exposed central portion of the anorthosite and its associated granulites.

OUTPUTS:

Fourteen page report in 1986 Report of Field Activities, and 1:50 000 preliminary map. Thirteen analyses of representative phases of West Channel anorthosite.

FOLLOW-UP AND IMPLICATIONS:

Textural and compositional similarities throughout the region strongly support Bell's contention that "the various bodies once formed a continuous sill which has since been modified by metasomatic replacement". Although no chromitite seams were discovered during 1986, the initial appraisal suggests mineralogical and textural similarities with the Fiskenaesset complex in Greenland, a generally high anorthosite (and alumina) content, as well as some potential for building stone. More intensive ground traverses in 1987 will concentrate in the Lochhead Lake area to search for massively jointed potential building stone, and to obtain further information on the anorthosite's mode of origin. Pilot sampling of the Minago River body will also be initiated.

PROJECT 1.12: Field and evaluation support for northern Superior U-Pb geochronology program

INVESTIGATORS: W. Weber in cooperation with T. Krogh, L. Heaman and N. Machado, Royal Ontario Museum and Geological Survey of Canada

OBJECTIVES:

To provide a geological framework, collect and provide rock samples for U-Pb isotope investigations, and to contribute to the geological evaluation of the U-Pb ages determined in the laboratories of the Royal Ontario Museum. Analyses are funded by the GSC.

PROGRESS:

Eight samples from the Thompson belt and four samples from the Cross Lake area were collected and 23 additional zircon fractions were analyzed.

PRODUCTS:

- Report in MSGB Report of Field Activities 1986.
- Internal Progress Report by ROM - March 1987.
- One paper published in "Contributions to Mineralogy and Petrology".
- Two presentations at the GAC-MAC 1986 meeting.
- One presentation to the GAC-MAC 1987 meeting.

FOLLOW-UP AND IMPLICATIONS:

Several more units will be collected during the 1987 field season, specifically supracrustal and granitoid rocks of the Thompson belt.

Results date the late Hudsonian tectonic overprint in the Thompson belt and indicate that Thompson belt consists of thrust(?) slices.

PROJECT 1.15: Project management

INVESTIGATOR: W. Weber

OBJECTIVES:

- To enable supervision of field projects and conduct field demonstrations for potential MDA contributors.
- Participate in MDA related field demonstrations.

PROGRESS:

A field trip was conducted in the Thompson area. One longer field trip and Workshop planned for an international group had to be cancelled because of flood conditions along the Nelson River system.

PRODUCTS:

Coordination of regional operations, syntheses of regional geology, integration of otherwise isolated and individual project contributions.

FOLLOW-UP AND IMPLICATIONS:

- Field trip in the Thompson district in 1987.
- Evaluation of airborne gradiometer surveys in the Bissett region to complement GSC and MGSB field projects.

PROJECT 1.16.2: Thompson belt geochemistry

INVESTIGATOR: N.M. Halden

OBJECTIVES:

To provide geochemical fingerprinting of mafic and ultramafic rocks in Thompson belt supracrustal belts.

PROGRESS:

Samples from Ospwagan-Assean and Moak Lake were collected and partially processed (beads). XRF analyses were delayed because of electrical problems in the new Geological Sciences Building of the University of Manitoba and start-up difficulties with the new XRF equipment

PRODUCTS:

Report (GS-37) in Report of Field Activities 1986.

FOLLOW-UP AND IMPLICATIONS:

After completion of analyses geochemical discrimination will yield more precise information related to the tectonic setting of mafic and ultramafic volcanic rocks at the Superior craton margin and provide data on the tectonic assembly of the Thompson belt and genesis of nickel deposits.

PROJECT 2.20: Rare-element-enriched pegmatite evaluation

INVESTIGATORS: P. Černý (Univ. of Manitoba) (G.H. Gale)

OBJECTIVES:

This project is designed to investigate and document occurrences of rare-element-enriched pegmatites in north-central Manitoba and to establish techniques for exploration and evaluation.

PROGRESS:

This project is on schedule and proceeding as planned. Several pegmatite fields have been delineated and studied. A new rare-element-bearing field has been discovered to date. Follow-up work was done in the Red Sucker Lake pegmatite field. Lab work was in progress on the 1985 material from Red Cross Lake, and nearly concluded on material from Red Sucker and Gods Lakes.

PRODUCTS:

- Annual report at fiscal year end received March 1987.
- Preliminary reports in 1984, 1985, 1986 Reports of Field Activities.
- Preliminary version of L. Chackowsky's M.Sc. thesis on the Red Sucker Lake and Gods Lake areas received March 1987.

FOLLOW-UP AND IMPLICATIONS:

This contract will be renewed for 1987. Field work will concentrate on the Magill Lake pegmatitic granite with limited follow-up in the Red Sucker Lake and Cross Lake areas. Lab work will conclude the Red Sucker Lake and Red Cross Lake studies and will commence evaluation of the Magill Lake granite.

PROJECT 5.7: Thompson-Pikwitonei compilation

INVESTIGATORS: W. Weber and J.J. Macek

OBJECTIVES:

To provide a comprehensive and up-to-date regional geological framework for identification of more mineral exploration targets.

PROGRESS:

U-Pb dating by ROM (see MGSB Project 1.12) largely funded by the GSC has provided a partial framework for compilation. Project 1.10 provided additional data. University research (State University of New York, University of Wisconsin), which is NSF funded, provided additional petrological data.

PRODUCTS:

Included in project reports (i.e. MGSB Project 1.12). Fiscal year-end Internal reports.

FOLLOW-UP AND IMPLICATIONS:

- Work mentioned under Progress will continue for another two years.
- Detailed documentation of supracrustal rocks started at Thompson Pit (Project 1.11.2) to be extended southwards in 1987.
- GSC structural work C.1.1.5 and C.2.2.6 to be coordinated with C.1.1.4, MGSB 1.11.2, 1.12, 1.16.1, and 1.16.2 for optimum results.
- Contacts with Inco and Falconbridge to continue in order to obtain access to surface, drill, and geophysical data necessary for the 1:250 000 synoptic geological compilation.

GEOLOGICAL SURVEY OF CANADA

PROJECT C.1.1.4: U/Pb geochronology, N.W. Superior Province

INVESTIGATORS: T.M. Gordon (LCSD)
T. Krogh (ROM)

OBJECTIVES:

Contract to T. Krogh, of the Royal Ontario Museum, to sample selected areas within the Pikwitonei granulite domain, Thompson belt and Cross Lake region for U/Pb geochronological studies. These studies will support concurrent work being carried out in these regions by federal and provincial geologists. The age dating will assist in further defining the structural evolution of the Superior plate margin.

PROGRESS:

Approximately 12 samples from Thompson Pit, Cross Lake, and Split Lake were collected and are undergoing processing. Work continued on refining numbers from samples run in 1985/86.

PRODUCTS:

Results to date were published as abstracts in the 1986 GAC, MAC, CGU annual meeting in Ottawa:

"Preliminary U-Pb zircon results from the Pikwitonei granulite terrain, Manitoba" by L. Heaman, N. Machado, and T. Krogh; and

"U-Pb zircon ages for the Molson dyke swarm and the Fox River Sill, NE Manitoba" by N. Machado, L. Heaman, and T. Krogh.

FOLLOW-UP AND IMPLICATIONS:

Processing of samples from the Thompson belt (Pipe Pit, Thompson Pit), and the Cross Lake belt will continue. Results will be presented at a national meeting and published on completion.

Age relationships are necessary to understand the basic geological framework and construct metallogenic models.

PROJECT C.1.1.5: Structural studies, Thompson belt

INVESTIGATORS: E. Froese (LCSD)
F. Fueton (U. of T.)

OBJECTIVES:

To determine direction and timing of various structural blocks bordering the Nelson Front, by studying major shear zones within the Thompson belt.

PROGRESS:

Frank Fueton essentially completed field work for his Ph.D. thesis on a 2 km x 15 km transect across the Thompson belt from the Pikwitonei terrane to the Churchill Province, concentrating on studies of granitoid gneisses.

The style of deformation changes and the intensity of deformation increases towards the Churchill-Superior boundary. The most prominent structural features stem from the Hudsonian overprint on Archean and Proterozoic rocks and suggest vertical movements. This constitutes a constraint for tectonic models of the Churchill-Superior boundary.

PRODUCTS:

Publication of results in Current Research GSC Paper 87-1B. Presentation of data in posters at Manitoba Meeting with Industry and GSC Open House, plus presentation of data at FONB workshop, Winnipeg, April 1986.

FOLLOW-UP AND IMPLICATIONS:

Frank will spend six weeks in the field to complete structural studies along a transect across the Thompson belt. Results will be presented in a Ph.D. thesis and in Current Research 88-1B.

Project carried out in cooperation with Inco Metals Company which supplied information on the Pipe 2 Mine. Correlation of structural features between the Thompson and Pipe 2 Mines will lead to elucidation of structural control of severely deformed orebodies.

An understanding of mafic intrusion-related gold mineralization is important in view of similar large tonnage deposits in Western Australia (Kalgoorlie) and Chibougamou (Barbeau Sill), as well as the Tartan Lake Mine in the Flin Flon district and the Seabee deposit in the LaRonge belt.

Regional mapping at 1:10 000 scale will allow explorationists to better understand the volcanic and tectonic environments in which these mineralized intrusions occur.

PROJECT C.2.2.6: Mafic-ultramafic studies, Thompson Nickel Belt

INVESTIGATORS: O.R. Eckstrand (MRD)
P. Williams (U. of N.B.)
W. Bleeker (Ph.D.)

OBJECTIVES:

To study the structure and related geology of the nickel deposits at the Thompson Mine with the objective of determining their structural and metamorphic history and, if possible, defining new exploration targets. This will involve mapping of the new open pit, underground workings and drill core. Inco has indicated their interest and cooperation in supporting the study which will be carried out by Walter Bleeker, a graduate student under the supervision of Dr. Paul Williams (U. of New Brunswick), and the field supervision of Dr. Cees Van Staal, GSC.

PROGRESS:

W. Bleeker has carried out detailed structural and petrographic work for a Ph.D. thesis on the Thompson Open Pit portion of the Thompson orebody. Progress to date includes:

1. Detailed mapping at appropriate scales of the available pit exposures under current production.
2. Extensive sampling for petrographic, microstructural, geochemical and geochronologic studies.
3. A preliminary report has been submitted with a more complete version to be published in Current Research Paper 87-1B.

At least five periods of deformation are recognized, the first characterized by great complexity, the highest degree of strain, and peak metamorphic conditions. This period may be largely responsible for the stratiform character of the Thompson orebody. The antiformal structure of the horizon is a late feature, correlated with the fourth period of deformation.

PRODUCTS:

Walter presented his data to the FONB workshops in Winnipeg and presented a poster at the Manitoba Meeting with Industry.

FOLLOW-UP AND IMPLICATIONS:

1. 1:20 000 (or more detailed) scale mapping in the open pit, and surrounding outcrops will be completed.
2. All exposures in the area surrounding Thompson structure, and the other nickel sulphide deposits in the belt will be examined.
3. Underground mapping as required to complete the characterization of the Thompson ore structures will be carried out.
4. Sampling for petrographic, geochemical, geochronologic and microstructural studies. Laboratory and office studies at U.N.B. will include further petrographic, geochemical and microstructural analysis, and radiometric dating as deemed feasible.

DISTRICT V. NORTHWEST SUPERIOR PROVINCE, GODS - ISLAND LAKES REGION

Summary and Project Listing:

A reconnaissance of the Ponask Lake region encountered widespread mylonites, amphibolites and quartz diorite, but, with the exception of some small mafic intrusions, no economically significant mafic or ultramafic complexes were encountered.

The geological map for Bigstone Lake was completed.

The continuing evaluation of rare-element pegmatites in the Province, by the University of Manitoba, has brought to light extensive and possibly economically significant occurrences of petalite in pegmatitic leucogranite at Red Sucker Lake. The associated highly fractionated geochemical anomaly is not only large but compares favourably with that developed over the Bernic Lake pegmatite in southeast Manitoba.

GSC

Regional lake sediment geochemical surveys were extended to the Red Sucker Lake and Island Lake region (NTS areas 53K, 53M (S 1/2) and 53E (N 1/2)), with release as Open Files scheduled for July 1987.

MANITOBA GEOLOGICAL SERVICES BRANCH

PROJECT 1.13: Bigstone Lake-Ponask Lake mapping

INVESTIGATORS: W. Weber and K.L. Neale

OBJECTIVES:

The objective is to provide an updated geological data base interpreted on the basis of modern concepts of base and precious metal deposits in order to assist mineral exploration which is presently active in this area.

PROGRESS:

One map sheet issued in 1984 was revised incorporating 1984 and 1985 field data of Bigstone Lake area.

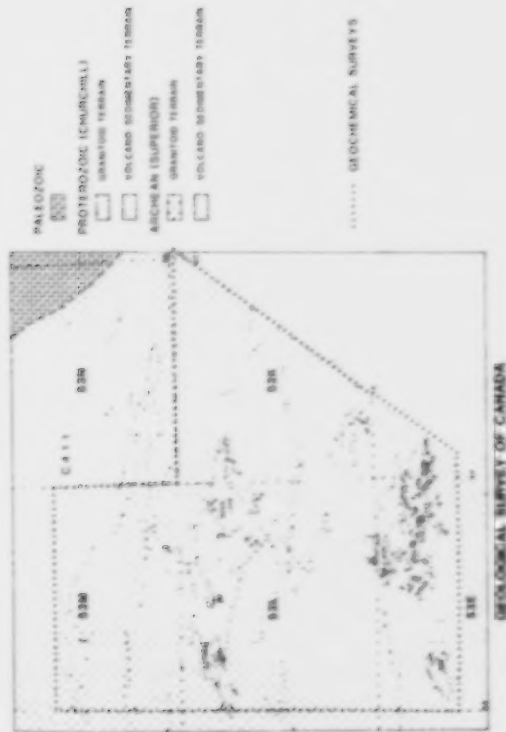
Ponask Lake area was mapped.

PRODUCTS:

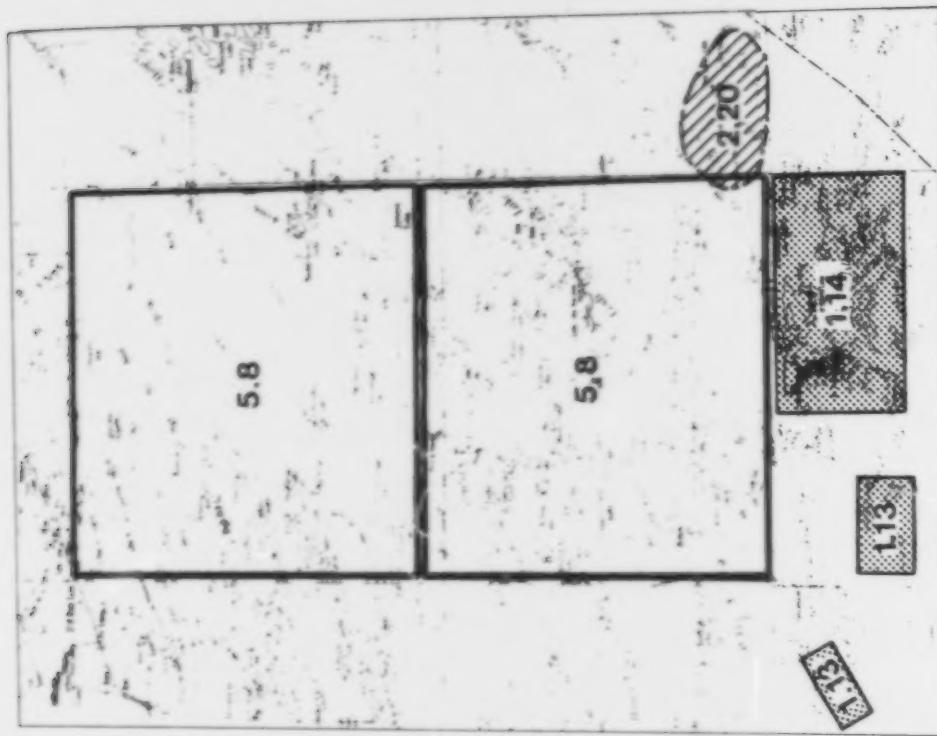
- Revised Preliminary Map 1986B-1: Bigstone Lake, 1:20 000 scale, by K.L. Neale, et al.
- Preliminary Map, 1986I-1: Ponask Lake, 1:20 000 scale and Report of Field Activities.

FOLLOW-UP AND IMPLICATIONS:

Two (2) rock units are being dated by the U-Pb zircon method to establish whether the two-fold subdivision recognized in the Bigstone Lake area is correlative with the two-fold subdivision in the Island Lake area.



C.4.1.1 Geochemical Survey
 Company: SIAL Compagnie
 Internationale de
 Géophysique inc.
 Base: not known at present



MANITOBA GEOLOGICAL SERVICES BRANCH

- 1.13 Bigstone and Ponask Lakes geological mapping
- 1.14 Island Lake geological mapping
- 5.8 1:250 000 synoptic geological compilation, Gods Lake

Figure 8: Location of Sector A projects (1986) - DISTRICT V: GODS-ISLAND LAKES

**PROJECTS 1.14 and 1.14.1: 1:20 000 scale geological mapping,
Island Lake area**

INVESTIGATORS: H.P. Gilbert and W. Weber

OBJECTIVES:

To provide an updated geological data base of the Island Lake area and Stevenson Lake area in order to stimulate and support mineral exploration for gold and base metals. Stratigraphic and geochemical investigations of the Hayes River Group volcanic rocks, and the significance of known mineral deposits in the area will be major objectives.

PROGRESS:

Eighty-three volcanic rocks have been analyzed.

PRODUCTS:

Preliminary maps of the project areas are available, and summary reports covering the stratigraphy, structure and economic geology are given in Reports of Field Activities for 1981 to 1985.

FOLLOW-UP AND IMPLICATIONS:

Continuation with analysis of field data and preparation of final maps and report. This will provide an important data base for future mineral exploration in the district. Mapping indicated that the volcanics of the north shore of Island Lake might be of different age (older?) than the mafic-felsic sequence (about 2840 Ma) in the central and southern part. This should be verified by geochronology. Stevenson Lake geology and mineral potential are comparable to the western part of Island Lake.

PROJECT 1.17: Northwest Superior pegmatite evaluation

INVESTIGATOR: P.G. Lenton

OBJECTIVES:

The objectives of this project are: 1) to provide an updated and detailed geological and mineralogical data base for rare-element-enriched pegmatites and associated granites, and 2) establish regional geological environment and criteria for source and mode of emplacement. This survey complements geochemical and research activities into rare-element-enriched pegmatites conducted by P. Černý of the University of Manitoba.

PROGRESS:

The program was terminated at the end of fiscal year 1985/86 since it indicated a more restricted occurrence of rare-element-enriched pegmatites than expected. Work was instead redirected into Cross Lake and adjacent areas (see Projects 1.11.1, 1.11.2).

PRODUCTS:

The investigative field work is now terminated. Results of this work including all analytical work will be included in the final report of Cross Lake area.

FOLLOW-UP AND IMPLICATIONS:

The University of Manitoba will continue the detailed documentation at Red Cross, Red Sucker, Gods and Magill Lakes.

PROJECT 5.8: 1:250 000 compilation - Gods Lake

INVESTIGATORS: W. Weber, P. Gilbert and D.C.P. Schledewitz

OBJECTIVES:

To review and assemble data for 1:250 000 geological compilation.

PROGRESS:

Map for NTS 53L is completed including marginal notes. The compilation map for 53M has been started.

PRODUCTS:

Hand-coloured map displayed at Manitoba Open House.

FOLLOW-UP AND IMPLICATIONS:

Synoptic geological compilations at a scale of 1:250 000 for NTS areas 53L and 53M will be completed in the 1986/87 fiscal year.

53L will be printed and 53M will be prepared.

GEOLOGICAL SURVEY OF CANADA

PROJECT C.4.1.1: Geochemical surveys

INVESTIGATORS: E.H.W. Hornbrook (MRD)
 P.W.B. Friske (MRD)
 R. Schmitt (MRD)

OBJECTIVES:

To conduct regional geochemical reconnaissance surveys in selected areas of Manitoba which will be determined after discussions with Provincial counterparts. Sample collection, preparation and analysis will be contracted out while the final open file production and joint release will be done in the GSC. Proposed areas include 64B, F, G; 63-I, N, P; 53E (part), L, M (part), 52M (part) and 62P (part).

PROGRESS:

1. Results of the 1985 lake sediment and water survey in northern Manitoba (parts of 63K, N, O) were released on June 25, 1986 as GSC Open File 1212 (22 geochemical maps, plus text). Approximately 14 450 hectares were staked within the survey area following the release (up to mid-September).
2. Archived sampled from 64B and 64C were analyzed for Au, Sb and F (64B only). Results were released on July 23, 1986 as GSC Open File 1287 (4 geochemical maps, plus text) and 1288 (3 geochemical maps, plus text). Approximately 3020 hectares were staked within the survey area following the release (up to mid-September).
3. The 1986 field component of a regional lake sediment and water survey in northeastern Manitoba (parts of 53E, F, K, L, M) was completed during July and August, 1986 (area about 38 700 km²; sample density 1/13 and 1/6.5 km²).

PRODUCT:

Poster at Manitoba Meeting with Industry; GSC Open Files 1212, 1287.

FOLLOW-UP AND IMPLICATIONS:

A lake sediment and water survey will be carried out over NTS 63P (southeast quadrant), all of 63-I and 63H (northeast quadrant) for total of 1.5 map areas.

The Granville Lake area (NTS 64C) data will be evaluated through statistical analysis and maps will be produced emphasizing target areas of interest (coincident element anomalies, etc.) for detailed exploration. The results of this analysis combined with the results of the geochemical till sampling program will allow exploration companies a multi-level approach to grassroots exploration in the area.

PROJECT C.2.2.4: Fox River Sill

INVESTIGATORS: R.F.J. Scoates (MRD)
O.R. Eckstrand (MRD)
P.L. Schwann (Carleton U.)

OBJECTIVES:

The project is designed to contribute to the understanding of magmatic processes that give rise to concentrations of platinum-group sulphides in certain stratigraphic horizons of the Fox River Sill. Cryptic variations of silicate mineral compositions, distribution and interelement association of PGE's as well as detailed igneous stratigraphic studies will contribute to assessing the potential of this intrusion to host economic concentrations of PGE's.

PROGRESS:

The results of electron microprobe analyses of primary silicate and oxide minerals in cyclic units of the Upper Central Layered Zone of the Fox River Sill were reported by R.F.J. Scoates (GSC) and M. Raudsepp and A.C. Turnock (U. of M.) at the 1986 GAC/MAC meeting in Ottawa (abstract).

The final report (received in September 1986) listed complete analyses for 115 additional minerals. These results will be incorporated into continuing (GSC) research on the Fox River Sill. The results suggest that small-scale cyclic units are more evolved than large-scale cyclic units and this has implications for platinum group element concentrations in this intrusion.

P.L. Schwann and R.F.J. Scoates logged and sampled drill core from three EP-Selco drill holes. The holes intersected approximately 300 m of stratigraphy of the Fox River Sill that contains a number of zones of platinum group element-bearing sulphides. Petrochemical studies based on the collected data are continuing and will form the basis of P.L. Schwann's M.Sc. thesis study at Carleton University. This work follows up work by R.F.J. Scoates and O.R. Eckstrand on Fox River Sill platinum group element-bearing sulphides. (R.F.J. Scoates and O.R. Eckstrand, 1986: Platinum group elements in the Upper Central Layered Zone of the Fox River Sill, Northeastern Manitoba; Economic Geology, v. 81, p. 1137-1146).

PRODUCTS:

See progress.

FOLLOW-UP AND IMPLICATIONS:

Four drill holes remain to be logged and sampled from BP-Selco's 1986 exploration program. Further exploration drilling is anticipated during the

1986/87 exploration season. R.F.J. Scoates, O.R. Eckstrand and P.L. Schwann will log and sample available drill core for continuing petrochemical studies. A one week field program (RFJS, PLS, ORE) designed to provide detailed samples of Marginal Zone and Lower Central Layered Zone exposures in the Great Falls outcrop area is tentatively planned. This will only be implemented if there is exploration activity in the area so that we can maximize logistics and mobilization efficiencies.

DISTRICT VI: MANITOBA GENERAL

WINNIPEG-BASED

Summary and Project listing:

Documentation of industrial minerals in the Duck Mountain area was undertaken to provide background data for an industrial minerals potential map, the first of several intended for southern Manitoba.

Four projects were conducted as part of the stratigraphic mapping, and stratigraphic and industrial minerals drilling program. Sampling and core drilling of the Stonewall Formation were undertaken to provide accurate stratigraphic control on the location of the Silurian/Ordovician boundary in Manitoba. Additional drilling was undertaken to obtain a detailed profile of a Winnipegosis reef and to establish a model for reef development.

Outcrop mapping was completed in the Clearwater-Cormorant-Moose Lakes area as part of an extensive program, also involving 'scout' drilling, designed to provide information on the lower Paleozoic sequences, as well as additional control on the distribution of units in the Precambrian basement inferred from gradiometer surveys conducted by the GSC.

Three Precambrian sites in southeastern Manitoba were cored as part of a project to evaluate the quality of selected granitic rocks as ornamental/dimension stone. Six sites on the Lac du Bonnet Batholith were mapped in detail to evaluate dimension stone potential. Brochures have been completed illustrating Manitoba dimension stone, and Industrial Minerals together with a reference folio of typical samples of dimension stone.

MANITOBA GEOLOGICAL SERVICES BRANCH

PROJECT 2.21: Lead-zinc potential of carbonate rocks in southern Manitoba

INVESTIGATOR: G.H. Gale

OBJECTIVES:

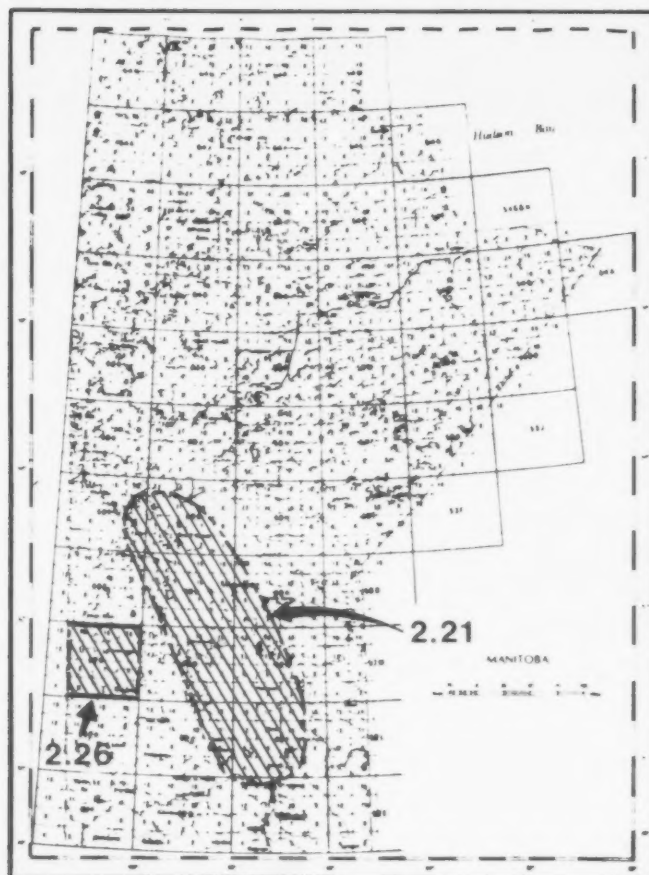
To identify the source of galena float discovered in Manitoba and to determine the potential for occurrence of lead and zinc in carbonate rocks of Manitoba.

PROGRESS:

Phase I of the project is completed. Drill cores have been cut and crushed. The data are filed for computer manipulation. Heavy mineral separates have been completed for all profiles.

PRODUCTS:

None in 1986-87.



MANITOBA GEOLOGICAL SERVICES BRANCH

- 1 Laboratory assistant (seasonal)
- 2.21 Pb/Zn in Paleozoic
- 2.26 Industrial minerals mapping, Dauphin Lake
- 5.9 Bibliography and other compilations
- 5.12 Winnipeg based mineral deposit compilations

Figure 9: Location of Sector A projects (1986) - DISTRICT VI: MANITOBA

FOLLOW-UP AND IMPLICATIONS:

The data will be processed and an open file report will be prepared for November 21, 1987(?). The results will dictate the extent and type of work to be undertaken as Phase II of this project.

PROJECT 2.26: Industrial minerals mapping, Duck Mountain

INVESTIGATOR: B.E. Schmidtke

OBJECTIVES:

The purpose of this program is to document the nature, extent and reserves of all industrial minerals occurrences in the Duck Mountain map area NTS 62N. Occurrences of dolomite, glauconite, silica sand, lignite and bentonite will be examined and sampled, and the geological setting of the occurrences described in detail.

PROGRESS:

Known industrial minerals occurrences in the north half of the NTS 62N map sheet were examined and sampled. Several peat bogs with a potential for fuel or horticultural peat were sampled.

PRODUCTS:

Preliminary report (GS-41) in Report of Field Activities 1986 describes the findings in NTS 62N map sheet area.

FOLLOW-UP AND IMPLICATIONS:

Completion of this project has been delayed to concentrate manpower on the dimension stone resource assessment.

PROJECT 5.12: Mineral deposit compilations

INVESTIGATOR: G.H. Gale

OBJECTIVES:

To provide an organized data base for mineral deposit information on 1:50 000 scale base maps.

PROGRESS:

One assistant working with the project leader has established a standard format for this map series, two-1:20 000 maps are in a second draft stage.

PRODUCTS:

Two-1:20 000 prototype maps of 63K/13.

FOLLOW-UP AND IMPLICATIONS:

Two or three 1:50 000 NTS sheets will be completed for the Flin Flon area in the next 12 months. Text for the accompanying open file reports is being assembled and edited.

EXPLORATION SERVICES

Summary and Project listing

The Exploration Services Section of the Mines Branch continued core collection and cataloguing of existing holdings at its four facilities - Lynn Lake, Thompson, The Pas, and Winnipeg. A considerable effort was expended to condense holdings at Lynn Lake and Thompson, and in the construction of additional racking at the Thompson River Base. Consolidation of core in Winnipeg has been suspended and awaits the availability of new quarters at Midland Street currently occupied by the Department of Highways.

Compilation work resulted in the issuance of several new brochures and publications, including a Bibliography of Manitoba Geology, updates to the Manitoba Mineral Inventory, and the new Index to Non-confidential Assessment Reports.

MINES BRANCH

PROJECT 1.7.1 and 1.7.2: Drill core retrieval and storage

INVESTIGATORS: P.J. Doyle, J.K. Filo and D.E. Prouse

OBJECTIVES:

To collect Precambrian diamond drill core representative of various stratigraphic suites and mineral prospects for permanent storage in Provincial libraries so as to encourage mineral exploration in Manitoba by allowing future reexamination of this core and alleviating the high cost of redrilling.

PROGRESS:

During year three of the Agreement: 8126 metres of core were collected (stored and catalogued) in thirteen separate collections; all requests were initiated by industry; a selective reduction of high density drill projects in Thompson, The Pas and Lynn Lake resulted in the removal of 7749 boxes or 154 980 metres of core; seasonal assistance involved three to six individuals and a total of 561 field days were required to complete the work (April 1, 1986 to March 31, 1987); library improvements, site levelling, painting, building interior renovations, etc., were done in Lynn Lake, Thompson and The Pas; new core storage racks were built in Thompson and Lynn Lake that created an additional 48 910 metres of storage; reorganization, sorting and racking of core resulted in physical handling of 39 633 boxes; work continued on N.T.S.-based manual data files for the library system; 4630 boxes were labelled with computer generated tags and work on computerized library inventories was initiated.

PRODUCTS:

Summary (ES-1) in Report of Field Activities. Updated manual data file holdings. Display materials on the libraries program produced and used at Open House and the Prospectors and Developers Association Meeting.

FOLLOW-UP AND IMPLICATIONS:

During the third year of the Agreement, 25 general inquiries and 17 industry requests were answered. Seventeen core inspections were made resulting in 123 days of use, a 56% increase over Year II.

This program has given government personnel opportunity to interact with industry and continue to build rapport between private and public sectors. Frequent, year-round field work allows for collection of valuable information on Manitoba's exploration industry. Most importantly, utilization of the library system by industry has shown that the core storage program is an important contribution to the mineral exploration database in Manitoba. This program will continue to aid in re-evaluation of Manitoba's numerous mineral prospects for years to come.

PROJECT 5.9: Bibliographies, promotion, compilations

INVESTIGATORS: D. Fogwill, J. Bamburak, P. Leskiw, J. Richardson

OBJECTIVES:

To produce bibliographies/indexes for improving access to the large existing geoscience data base of Manitoba; to promote/display Manitoba's mineral potential to attract mineral investment in the Province; to liaise with the mining industry and monitor exploration activity; to inform the public about on-going mineral exploration/development and related career opportunities; and to produce mineral deposit/geophysical compilations.

PROGRESS:

Year three of the Agreement has seen continuation of standards achieved in the past two years.

A start has been made on adding periodical literature and theses to the computerized bibliographic data base. An updated index to the non-confidential assessment reports was produced. Publication and assessment coverage index maps were updated, and a new index map showing the outlines of government airborne geophysical surveys was compiled. The services pamphlet was revised, as well as, the companies and consultants lists.

Displays, featuring MDA field geological projects under Sector A, mining company exploration and mining projects, and the Drill Core program, were constructed for Open House and the Prospectors and Developers Convention. The publications price list was updated and five release notices were sent to addresses on the computerized mailing list.

The second annual Mineral Exploration Liaison Committee (MELC) meeting was attended on November 20, 1986. A total of 88 person-days (excluding the core libraries program) was spent in the field during 1986-87, principally visiting exploration sites and personnel.

Displays, promoting exploration and mining, were set up at four careers symposia (Flin Flon, Winnipeg, Norway House and Brandon). The Winnipeg display was, for the second year, a joint effort with the Mining Association of Manitoba.

A draft manuscript of "Gold Deposits of Manitoba" was displayed at the Prospectors and Developers Convention. Orders were taken for this joint Exploration Services-Geological Services publication which was well received by the delegates. Work continued on an update compilation of geophysical data in the Flin Flon-Snow Lake area.

PRODUCTS:

Bibliographic searches, by author, and title keywords can now be done from an on-line computerized data base, upon request.

Open File Reports OF86-1* and OF86-5 were produced by Exploration Services and released with OF85-5, OF86-2, OF86-4 and Bedrock Geology

Compilation Maps 64B and 64C during 1986-87. (Full titles are listed under Part IV: OUTPUTS of this report). Open File Reports OF84-2 and OF86-5 were reprinted and OF86-1 will be reprinted in the near future. Index Maps showing final (Map 7) and preliminary (Map 7A) geological maps issued by Geological Services were updated and Map 16 "Government Airborne Geophysical Surveys" was produced.

Summaries of project activities were published in the Canada-Manitoba Mineral Development Agreement Second Annual Report 1985-86; Sector A Geoscientific Activities Progress Report 1985-86; and Report of Field Activities 1986.

The following brochures were revised in November 1986 and March 1987:

- a. "Staff and Functions of the Geological Services Branch";
- b. "Staff and Duties of the Exploration Services Section";
- c. "Mining and Explorations Companies in Manitoba";
- d. "Selected Contractors and Consultants Serving the Exploration Industry in Manitoba"; and
- e. "Mineral Exploration Highlights".

The following brochures were revised in March 1987:

- a. "Mineral Exploration in Manitoba in 1986" and
- b. "Mineral and Exploration Services in Manitoba".

The Publications Price List was updated in May and October 1986, and Release Notices were mailed in April, June (2), August and November.

In addition, to these items, distributed to the mining industry and the public, permanent display material was produced for the various meetings and symposia.

FOLLOW-UP AND IMPLICATIONS:

Feedback from the mining industry, through questionnaires and personal contact, to our programs has generally been positive. This same level of achievement will be maintained in year four of the agreement.

Work on the bibliography will be directed to completing the serial literature and making a start on cross-referencing by NTS area and subject keywords. Promotional displays and handouts will be prepared for next year's meetings and symposia. Field trips to liaise with the mining industry and involvement with MELC will continue. "Gold Deposits of Manitoba" will be published and updating of the base metal mineral inventory cards will commence. A geophysical compilation on Flin Flon-Snow Lake; and index maps to "Airborne Surveys flown after 1975" and to "Lake Sediment, Water and Till Geochemistry and Gamma-Ray Spectrometry" surveys will also reach completion.

IV. OUTPUTS - PUBLICATIONS, PRESENTATIONS, DISPLAYS, BROCHURES

MDA PUBLICATIONS AND TECHNICAL INFORMATION RELEASES:

MANITOBA*

- i REPORTS -
 - Departmental publications
 - Report of Field Activities
 - Preliminary Maps
- ii UNPUBLISHED REPORTS -
 - (on file in Manitoba Energy and Mines, Geological Services Branch)
- iii EXTERNAL PUBLICATIONS
- iv MINERAL DEPOSIT FILES
- v DATA FILES
- vi PRESENTATIONS -
 - Manitoba Energy and Mines Annual Meeting
 - Other
- vii FIELD DEMONSTRATIONS
- viii DISPLAYS
- ix PHYSICAL ASSETS (MAJOR)

CANADA:

- x REPORTS
 - Geological Survey of Canada publications
 - Report of Field Activities, Manitoba
 - Preliminary Reports and Maps
- xi EXTERNAL PUBLICATIONS
- xii PRESENTATIONS/DISPLAYS

* Includes output of programming initiated/conducted during the Interim Mineral Agreement (1983)

MANITOBA

1. REPORTS

Departmental Publications

Bailes, A.H. and Syme, E.C.

In Press: Geology of the Flin Flon-White Lake area; Manitoba Energy and Mines Geological Services, Geological Map GR86-1-1.

Canada-Manitoba Mineral Development Agreement 1984-89 (ERDA) 1986: Sector A Geoscientific Activities Progress, Report 1985-86; Open File Report OF86-4.

Corkery, M.T. (Map Committee Chairman)

In Press: Geological Highway Map of Manitoba, scale 1:1 000 000; MDA Special Publication No. 1; distributed by Manitoba Energy and Mines.

Esposito, B. 1986: Index to Non-Confidential Assessment Reports; Open File Report OF86-5.

Esposito, B. 1986: Copper and zinc in Manitoba; Manitoba Energy and Mines Mineral Education Series.

Fedikow, M.A.F. 1986: Geology of the Agassiz Stratabound Au-Ag Deposit, Lynn Lake, Manitoba; Open File Report OF85-5.

Fedikow, M.A.F. 1987: Detection of gold mineralization and lithologic mapping within the Agassiz Metallotect (Lynn Lake area) utilizing black spruce (*Picea mariana*) bark; Manitoba Energy and Mines, Geological Services, Open File Report OF86-6

Fedikow, M.A.F. 1987: Results of a vegetation geochemical survey near Bissett, southeastern Manitoba; Manitoba Energy and Mines, Geological Services, Open File Report OF86-3.

Gunter, W.R. 1986: Gypsum in Manitoba; Manitoba Energy and Mines, Mineral Education Series.

Leskiw, P.D. 1986: Bibliography of Manitoba Geology 1; Manitoba Energy and Mines, Mines Branch, Open File Report OF86-1.

Manitoba Energy and Mines 1986: Granville Lake - NTS 64C, 1:250 000, with marginal notes; Geological Services, Bedrock Geology Compilation Map 64C.

Nielsen, E.

In Press: Till geochemistry of the Seal River area, east of Great Island, Manitoba; Manitoba Energy and Mines, Geological Services, Open File Report OF87-1.

Nielsen, E. and Fedikow, M.A.F. 1986: Till geochemistry of the Minton Lake-Nickel Lake area (Agassiz Metallotect), Lynn Lake, Manitoba; Open File Report OF86-2.

Richardson, D.J. 1986: Gold mineral inventory update of the Rice Lake greenstone belt; Manitoba Energy and Mines, Mines Branch, Inventory File.

Schledewitz, D.C.P. 1986: Geology of the Cochrane and Seal Rivers Area; Manitoba Energy and Mines, Geological Services, Geological Report 80-9.

Young, R.V. 1986: Sand and Gravel in Manitoba; Manitoba Energy and Mines, Mineral Education Series.

Report of Field Activities 1986 (Released November 21, 1986; 234 p.).

Introductory review
by W.D. McRitchie

LYNN LAKE DISTRICT

- GS-1 Mineral deposit studies in the Lynn Lake area
by D.A. Baldwin
- GS-2 Geological investigations in the Sheila Lake-Margaret Lake area
by K. Ferreira
- GS-3 Geological investigations in the Foster Lake-Wasekwan Lake area
by K. Ferreira
- GS-4 Vegetation geochemical studies, Lynn Lake and Snow Lake areas
by M.A.F. Fedikow
- GS-5 The Agassiz Metaltotect - Spider Lake area
by M.A.F. Fedikow
- GS-6 Till geochemistry east of the Ruttan Mine
by E. Nielsen
- GS-7 Till geochemistry in selected areas of northern Manitoba
by E. Nielsen

FLIN FLON DISTRICT

- GS-8 Schist Lake area (Athapapuskow Project)
by E.C. Syme
- GS-9 Geological investigations in the Tartan Lake-Lac Aimée area
by H.P. Gilbert
- GS-10 Mineral occurrence studies - Flin Flon area
by D. Parbery
- GS-11 Geology of the Tartan Lake gold deposit
by S. Peloquin, B. Tannahill and G.H. Gale
- GS-12 Geology of the Baker Patton area
by B. Tannahill and G.H. Gale
- GS-13 Mineralization and alteration of the Vamp Lake sulphide deposit
by R.S. Wadein and P. Laznicka
- GS-14 Geochemical analysis of granitic rocks in the Flon Flon-Snow Lake area
by N. Halden and G.S. Clark

- GS-15 Chisel-Morgan Lakes Project
by A.H. Bailes
- GS-16 Mineral deposit studies in the Snow Lake area
by M.A.F. Fedikow, C.T. Roney, G.J. Schmidt and T.J. Robbie
- GS-17 Evaluation of industrial mineral occurrences in the Flin Flon-Snow Lake area
by W.R. Gunter and P.H. Yamada
- GS-18 Kiseynew Project: Kississing Lake
by D.C.P. Schledewitz and G. Trembath
- GS-19 Kiseynew Project: Geological reconnaissance of Kiseynew Lake west
by W.D. McRitchie
- GS-20 Mineral investigations in the Kiseynew gneiss terrain
by G. Ostry
- GS-21 Project Cormorant - sub-Paleozoic investigations south of Flin Flon and Snow Lake
by W.D. McRitchie and I. Hosain

SOUTHEAST MANITOBA DISTRICT

- GS-22 Stratigraphy of the Manigotagan River Formation, Rice Lake greenstone belt.
by D.M. Seneshen
- GS-23 Stratigraphy and structure of the upper Stormy Lake Formation, Rice Lake greenstone belt
by D.J. Owens
- GS-24 Mineral deposit investigations in the Rice Lake greenstone belt
by P. Theyer and R. Gaba
- GS-25 Platinum Group Elements in southeastern Manitoba
by P. Theyer
- GS-26 A preliminary investigation of Quaternary placer gold in the Manigotagan area
by E. Nielsen
- GS-27 Industrial minerals of southeast Manitoba
by B.E. Schmidtke
- GS-28 Subsurface Precambrian geology of southeastern Manitoba south of 49°30'
by C.R. McGregor
- GS-29 Additional Precambrian geological information on the Black Island area based on diamond drill and aeromagnetic data
by C.R. McGregor

THOMPSON-CROSS LAKE DISTRICT

- GS-30 Butterfly Lake area
by M.T. Corkery
- GS-31 Cross Lake-Pipestone Lake anorthosite studies
by H.D.M. Cameron
- GS-32 Kiskittogisu-Playgreen Lakes area
by P.G. Lenton, M.T. Corkery and H.D.M. Cameron
- GS-33 Nelson River anorthosite evaluation
by W.D. McRitchie
- GS-34 Lithological investigations in Inco's Thompson open pit mine
by J.J. Macek
- GS-35 Evaluation of industrial mineral occurrences in the Thompson area
by W.R. Gunter and P.H. Yamada

- GS-36 U-Pb geochronology program: Northern Superior Province
by T. Krogh, L. Heaman, N. Machado, D. Davis and W. Weber
- GS-37 Geochemical characterization of mafic and ultramafic magmatism
along the Churchill-Superior boundary zone
by N.M. Halden

NORTHERN SUPERIOR DISTRICT

- GS-38 Geological investigations at Ponask Lake
by W. Weber
- GS-39 Mineralized pegmatitic granites at Red Sucker Lake, Manitoba
by L.E. Chackowsky and P. Černý

MANITOBA GENERAL

- GS-40 Stratigraphic mapping and stratigraphic and industrial minerals
core hole program
by H.R. McCabe
- GS-41 Industrial mineral occurrences in the Duck Mountain area
by B.E. Schmidtke
- GS-42 Landsat imagery maps of peat potential in the Grindstone Point
area
by B.E. Schmidtke
- GS-43 Investigations of Metamorphism in the Pikwitonei domain
by K. Mezger, S.R. Bohlen and G.N. Hanson
- GS-44 Rb-Sr geochronology of the Churchill-Superior boundary zone and
the Cross Lake area
by G.S. Clark
- GS-45 U-Pb zircon geochronology of the Big Sand Lake area, northern Manitoba
by W.R. Van Schmus and D.C.P. Schledewitz

EXPLORATION SERVICES

- ES-1 Manitoba's Precambrian drill core collection program
by P.J. Doyle and J.K. Filo
- ES-2 Compilation, promotion and exploration services
by J.D. Bamburak, D.J. Richardson and P.D. Leskiw

Preliminary Maps 1986 (released November 21, 1986)

- 1986B-1 Bigstone Lake (Part of 53E/12) 1:20 000
by K.L. Neale, J.G. Bardsley and R.M. Lemoine
- 1986C-1 Subsurface Precambrian geological map of southwestern
Manitoba 1:1 000 000
by C.R. McGregor
- 1986F-1 Schist Lake (Parts of 63K/12E and 12W) 1:15 840
by E.C. Syme
- 1986F-2 Tartan Lake-Lac Aimée (Part of 63K/13) 1:15 840
by H.P. Gilbert

- 1986I-1 Ponask Lake (Parts of 63H/15 and 16) 1:20 000
by W. Weber
- 1986K-1 Kississing Lake West half (63N/3) 1:20 000
by D.C.P. Schledewitz
- 1986K-2 Kississing Lake, East half (63N/3) 1:20 000
by D.C.P. Schledewitz
- 1986N-1 Butterfly Lake area (Part of 63-I/6) 1:20 000
by M.T. Corkery
- 1986N-2 Kiskitto, Kiskittogisu and Playgreen Lakes (Parts of 63-I/5
and 12, 63J/7,8,9, and 10) 1:50 000
by P.G. Lenton, W.D. McRitchie, M.T. Corkery and H.D.M. Cameron
- 1986R-1 Stormy Lake (Part of 52L/14SW) 1:1 000
by D.J. Owens
- 1986R-2 Manigotagan River (Part of 52L/14SW) 1:1 000
by D.M. Seneshen
- 1986S-1 Chisel-Morgan Lakes area (Part of 63K/16) 1:15 840
by A.H. Bailes

ii. UNPUBLISHED REPORTS (on file: Manitoba Geological Services Branch)

Baldwin, D.A. and Hosain, I.

- 1986: Residual exploration potential in Rusty Lake greenstone belt; Manitoba Mineral Resources Division, 7p.

Bleeker, W.

- 1986: Observations in the Thompson Pit: a progress report; unpublished; Geological Survey of Canada.

Černý, P.

- 1987: Rare-element-enriched pegmatite evaluation project: Summary report, April 1/86 - March 31/87, 8 p.

Chackowsky, L.E.

- 1987: Mineralogy, geochemistry and petrology of pegmatitic granites and pegmatites at Red Sucker Lake and Gods Lake, northeastern Manitoba; unpublished M.Sc. thesis, Department of Geological Sciences, University of Manitoba.

Davis, D.W.

- 1987: Interim report on geochronology in the Cross Lake area - March, 1987; Royal Ontario Museum.

Elliot, S.R.

- 1986: The geology and alteration of the Lar Deposit, Laurie Lake, Manitoba; submitted M.Sc. thesis, University of Waterloo, Waterloo, Ontario.

- Fuerten, F., Robin, P.-Y.F. and Pickering, M.E.
1986: Deformation in the Thompson belt: a progress report; unpublished; Geological Survey of Canada.
- Gunter, W.R. and Segard, S.
1987: Industrial Minerals of Manitoba.
- Halden, N.M.
1987: Geochemical investigation of granite and granitoid rocks in Snow Lake-Flin Flon area to determine geochemical characteristics of those units associated with known mineralization: Progress report; Applied Geoscience Research Agreement, University of Manitoba.
1987: Geochemical discriminant analysis of mafic and ultramafic rocks along the Churchill-Superior Boundary: Progress report; Applied Geoscience Research Agreement, University of Manitoba.
- Keller, R.
1987: Age of the Wanipigow River granite suite; B.Sc. Thesis, University of Windsor, Ontario.
- Leroux, M.
1987: Mineralogical study of garnet and anthophyllite rocks from the Sherridon area, Manitoba.
- Lewry, J.F.
1986: A Lithoprobe proposal for integrated geophysical and geological studies in the southwestern parts of the Early Proterozoic Trans-Hudson Orogen.
- Machado, N., Heaman, L. and T.E. Krogh
1987: Report on U-Pb dating of the Thompson belt and Pikwitonei granulite domain, Manitoba; unpublished, Royal Ontario Museum - Geological Survey of Canada.
- Peck, D.C.
1986: The geology and geochemistry of the Cartwright Lake area: Lynn Lake greenstone belt, northwestern Manitoba; unpublished M.Sc. thesis, University of Windsor, Windsor, Ontario; 270 p.
- Wadein, R.S.
1987: Mineralization and alteration of the Vamp Lake sulphide deposit: Progress report; Applied Geoscience Research Agreement, University of Manitoba.
- Weber, W.
1987: Summary of events in the Thompson belt based on U-Pb geochronology; Manitoba Energy and Mines.
- Weber, W., Ayres, L.P., Cameron, H.D.M., Corkery, M.T., Lenton, P.G., Macek J.J., Mezger, K. and Phinney, W.C.
1986: The Archean crust in the Pikwitonei-Cross Lake region, northern Manitoba; Field Trip Guidebook; unpublished; Manitoba Energy and Mines.

iii. EXTERNAL PUBLICATIONS

Agricola Mineralia

1987: Manitoba Stone; Canada-Manitoba Economic & Regional Development Agreement: Minerals, distributed by Manitoba Energy and Mines.

Bailes, A.H.

1987: Silicification, Fe-Mg metasomatism and synvolcanic plutonism, Snow Lake, Manitoba; in Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 12.

Baldwin, D.A., Syme, E.C., Zwanzig, H.V., Gordon, T.M., Hunt, P.A. and Stevens, R.P.

in press: U-Pb zircon ages from the Lynn Lake and Rusty Lake metavolcanic belts, Manitoba: Two ages of Proterozoic magmatism; Canadian Journal of Earth Sciences.

Černý, P. and Meintzer, R.E.

in press: Fertile granites in the Archean and Proterozoic fields of rare-element pegmatites: crustal environments, geochemistry and petrogenetic relationships; CIM Conference on "Granite-Related Mineral Deposits": CIM Special Volume 39.

Clark, G.S. and Weber, W.

in press: Rubidium-strontium age and origin of uraniferous granite, Molson Lake-Red Sucker Lake area, northwestern Superior Province, Manitoba; Canadian Journal of Earth Sciences.

Clark, G.S. and Schledewitz, D.C.P.

in press: Rubidium-strontium ages of Archean and Proterozoic rocks in the Nejanilini and Great Island domains, Churchill Province, northern Manitoba, Canada; Canadian Journal of Earth Sciences.

Ercit, T.S., Anderson, A.J., Černý, P. and Hawthorne, F.C.

1986: Bobfergusonite - a new primary phosphate mineral from Cross Lake, Manitoba; Canadian Mineralogist, v. 24, p. 599-604.

Ercit, T.S., Hawthorne, F.C. and Černý, P.

1986: The crystal structure of bobfergusonite; Canadian Mineralogist, v. 24, p. 605-614.

Fedikow, M.A.F.

1986: Gold mineralization associated with the Agassiz Metallotect and the Johnson Shear Zone, Lynn Lake greenstone belt, Manitoba; in Gold in the western Shield; Canadian Institute of Mining and Metallurgy, Special Volume 38, p. 361-378.

- Gordon, T.M., Hunt, P.A., Loveridge, W.D., Bailes, A.H. and Syme, E.C.
1987: U-Pb zircon ages from the Flin Flon and Kiseeynew belts, Manitoba: Chronology of early Proterozoic crust formation; in Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 12.
- Halden, N., Clark, G.S., Lenton, P.G., Corkery, M.T. and Schledewitz, D.C.P.
1987: Geochemical and isotope constraints on the tectonic significance of the Chipewyan batholith, and Proterozoic magma genesis; Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 12.
- Heaman, L.M., Machado, N., Krogh, T.E. and Weber, W.
1986: Precise U-Pb zircon ages for the Molson dyke swarm and the Fox River sill: Constraints for Early Proterozoic crustal evolution in northeastern Manitoba, Canada; Contributions Mineralogy and Petrology, v. 94, p. 82-89.
- Heaman, L.M., Machado, N., Krogh, T. and Weber, W.
1986: Preliminary U-Pb zircon results from the Pikwitonei granulite domain, Manitoba; in Geological Association of Canada-Mineralogical Association of Canada, Program and Abstracts, v. 11, p. 79.
- Machado, N., Heaman, L., Krogh, T.E. and Weber, W.
1986: U-Pb zircon ages of the Molson Dyke swarm and the Fox River sill, NE Manitoba; in Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 11, p. 97.
- 1987: U-Pb geochronology of the Thompson mobile belt, Manitoba: Preliminary results. Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 12.
- McRitchie, W.D.
1987: Geological program highlights 1986-87, Geological Services Branch, Manitoba Energy and Mines; Provincial Geologists Journal 1986, v.4, p.42-50.
- Mezger, K., Bohlen, S.R. and Hanson, G.N.
1986: Metamorphic pressures and temperatures from the Pikwitonei domain, northern central Manitoba, Canada; Abstract; American Geophysical Union, Spring meeting 1986, Baltimore, Maryland.
- Stewart, J., Gilbertson, D. and Dixon, R.
1986: Peatland Inventory of Manitoba: II - S.E. Manitoba using Landsat; Manitoba Natural Resources, Surveys and Mapping, Manitoba Remote Sensing Centre.

Syme, E.C.

- 1987: Stratigraphy and geochemistry of two Proterozoic arcs: Lynn Lake and Flin Flon metavolcanic belts, Manitoba; in Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 12.

Turek, A., Keller, R., Weber, W. and Van Schmus, W.R.

- 1987: New U-Pb zircon ages for the Rice Lake greenstone belt, southeastern Manitoba; in Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 12.

Wang, X.J., Černý, P., Chackowsky, L.E. and Eby, R.

- 1986: Evolution of K-feldspar in the Red Cross Lake pegmatitic granite and its pegmatite aureole, northeastern Manitoba, Canada; International Mineralogical Association Meeting, Stanford, California, Program and Abstracts, 262.

Weber, W.

- 1987: The Churchill-Superior boundary zone: Constraints for the tectonic evolution of the southeastern margin of the Trans-Hudson orogen; in Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 12.

Weber, W. and Gordon, T.M.

- 1987: Project Cormorant: An attempt to delineate Precambrian basement geology beneath Paleozoic carbonates south of Flin Flon-Snow Lake; Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 12.

Zwanzig, H.V.

- 1987: Stratigraphy and tectonics of the Kiseeynew complex, Manitoba; in Geological Association of Canada-Mineralogical Association of Canada, Program with Abstracts, v. 12.

iv. MINERAL DEPOSIT FILES:

- 30 Files on gold occurrences in the Bissett area.
35 Files on mineral occurrences in the Snow Lake area.
8 Files on industrial mineral occurrences in the Dauphin area.
6 Files on industrial mineral occurrences in southeast Manitoba.

v. DATA FILES:

- 200 Chemical analyses of rock from Flin Flon area (whole rock and trace element); half of them also rare element data.
80 Chemical analyses of rocks from the Cross Lake area (whole rock and trace elements); 11 of them also rare

earth.

100	Partial and whole rock and trace element chemical analyses from Pipestone Lake anorthosite.
85	Chemical analyses from Island Lake area.
15	Chemical analyses of quartzite, Manasan quarry.

vi. PRESENTATIONS:

MANITOBA ENERGY AND MINES ANNUAL MEETING WITH INDUSTRY - NOVEMBER 21, 1986

Review of Activities	W.D. McRitchie
Highlights of the Provincial Minerals Investigations Program	G.H. Gale
Highlights of the Provincial Geological Mapping Program	W. Weber
Provincial Industrial Minerals	W.R. Gunter
Quaternary Investigations, a Review	E. Nielsen
Geological Survey of Canada Mineral Development Agreement Programming	A.G. Galley
Applied Geoscience Research at the University of Manitoba	N. Halden
A proposed model for Winnipegosis reefs in Manitoba	H.R. McCabe
The nature and timing of synvolcanic plutonism, hydrothermal activity and Zn-Cu sulphide mineralization, Chisel-Morgan Lakes area	A.H. Bailes
Falcon Lake Igneous Complex, new perspectives	W.C. Brisbin
Geochemistry and biogeochemical investigations of the Agassiz Metaltect	M.A.F. Fedikow
Structure and stratigraphy of the Kisseynew gneisses, at Kississing Lake	D.C.P. Schledewitz

OTHER PRESENTATIONS

MDA projects specific to Lynn Lake district
by D.A. Baldwin, at Lynn Lake Town Council, May 1986.

Industrial Minerals of Manitoba
by W.R. Gunter, at Geological Sciences Building, University of Manitoba, March 1987.

Industrial Mineral activities in Manitoba
by W.R. Gunter, at Biennial Conference of Federal and Provincial Industrial Minerals Geologists, Ottawa, October 1986.

Review of Provincial Sector A activities for 1986-87
by W.D. McRitchie, at CIM Winnipeg Section, April 1986.

Quaternary overview of Northwestern Ontario, Manitoba and Saskatchewan
by E. Nielsen, at CIM Winnipeg Section, November 1987.

Gold in the Churchill Province, Manitoba
by G. Ostry, at CIM Snow Lake and Flin Flon, March 1987

Geology and characteristics of granitoid rocks in the Southern Indian Lake, Seal River and Chipewyan domains
by D.C.P. Schledewitz, at Lithoprobe Workshop, University of Manitoba, April 1986.

Industrial Minerals of Manitoba

by B.E. Schmidtke, at Geological Engineering, University of Manitoba, March 1987.

Geochronology and evolution of the Rusty Lake-Lynn Lake greenstone belts

by E.C. Syme, at Lithoprobe Workshop, University of Manitoba, April 1986

Platinum group element exploration in Manitoba

by P. Theyer, at CIM Snow Lake and Flin Flon, March 1987.

The Manitoba transect of the Trans-Hudson Orogen

by W. Weber, at Lithoprobe Workshop on Trans-Hudson Orogen, University of Manitoba, April 15, 1986.

vii. FIELD DEMONSTRATIONS

Syme, E. Field demonstration of Flin Flon-White Lake geology to Swedish geologists from Bolden, July, 1986.

Syme, E. Field demonstration of Flin Flon-White Lake geology to GSC geologists, July 1986.

Macek, J.J., Weber, W. and Zwanzig, H.V.

Field trip demonstration in Thompson (Thompson Pit), Sipiwesk Lake and Setting Lake for 20 members of FONB (Friends of the Nickel Belt) geologists from governments, universities and mining industry interested in new developments of the geology of the Thompson belt (3 days in June).

viii. DISPLAYS

	Canada	Manitoba
Annual Meeting with Industry, Winnipeg, Manitoba 1986	10	29
Annual Geological Survey of Canada Forum, Ottawa, January 1986	5	--
Annual Prospectors and Developers Convention, Toronto, March 1986	1	2

ix. PHYSICAL ASSETS (MAJOR)

A Compac 286 computer, an Epson Fx 286 printer, an HP7550 8-colour plotter, and a Summagraphics digitizer were acquired, along with Autocad - a software graphics plotting package.

CANADA

x. REPORTS

a) Geological Survey of Canada Publications

Bleeker, W.

in press: Structural history of the Thompson Ore Bodies, Thompson Open Pit, Manitoba; in Current Research, Geological Survey of Canada, Paper 87-1B.

Fuerten, F. and Robin, P.T.

in press: Deformation in the Thompson belt, Manitoba; in Current Research, Part B, Geological Survey of Canada, Paper 87-1B.

Zaleski, E.

in press: The Linda hydrothermal systems, Snow Lake area, Manitoba; in Current Research, Part B, Geological Survey of Canada Paper 87-1B.

b) Manitoba Energy and Mines Report of Activities 1986 Publication

Krogh, T., Heaman, L., Machado, N., Davis, D., and Weber, W.

1986: U-Pb Geochronology Program: Pikwitonei-Thompson-Cross Lake; in Report of Field Activities 1986, Manitoba Department of Energy and Mines, p. 183-184.

c) Geological Survey of Canada Preliminary Reports and Maps

Regional lake sediment and water geochemical reconnaissance data, Province of Manitoba (63K, N, O); Geological Survey of Canada Open File 1212.

Regional lake sediment and water geochemical reconnaissance data, Province of Manitoba, archived samples 64B, 64C for Au, Sb and F; Geological Survey of Canada Open File 1287, 1288.

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d) Other:

Sub-Paleozoic compilation: Project Cormorant, Taiga Consultants; Geological Survey of Canada, Open File 1381.

xi. EXTERNAL PUBLICATIONS

Baldwin, D.A., Syme, E.C., Zwanzig, H.V., Gordon, T.M., Hunt, P.A. and Stevens, R.D.

in press: U-Pb zircon ages from the Lynn Lake and Rusty Lake metavolcanic belts, Manitoba; Canadian Journal of Earth Sciences.

- Duke, J.M., Scoates, R.F.J. and Williamson, B.L.
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xii. PRESENTATIONS/DISPLAYS

a) GSC Current Activities Forum, January 21-23, 1987, Ottawa

DiLabio, R.N.W.

1986: Placer gold at Manigotagan, Manitoba; Poster - Current Activities Forum.

Fueten, F. and Robin, P.Y.

1986: Deformation in the Thompson belt, Manitoba; Poster - Current Activities Forum.

Galley, A.G., Ames, D.E., Poulsen, K.H., and Franklin, J.M.

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Hulbert, L.

1986: Platinum group element environments in the Churchill Province of northern Saskatchewan and Manitoba; Current Activities Forum 1986 Program with Abstracts, Geological Survey of Canada, Paper 86-8, p. 9.

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1986: Glacial dispersal of Paleozoic carbonates in northwestern Manitoba.

Scoates, R.F.J., Duke, J.M., Eckstrand, O.R., and Williamson, B.L.

1986: Layer disruption, PGE mineralization and the role of supercooling in the crystallization of the Bird River Sill, Manitoba; Current Activities Forum 1986, Program with Abstracts, Geological Survey of Canada, Paper 86-8.

Zaleski, E.

1986: The Linda deposit hydrothermal systems, Snow Lake area Manitoba; Poster - Current Activities Forum.

b) Manitoba Energy and Mines Annual Meeting with Industry,
November 20-21, 1986, Winnipeg

Brisbin, W.C.

1986: Studies on the Falcon Lake Stock.

Galley, A.G.

1986: Activities of the Geological Survey of Canada in Manitoba during the 1986/87 field season.

Scoates, R.F.J.

1986: Contrasting modes of Platinum-Group Element mineralization in two Manitoba layered intrusions.

POSTERS

Ames, D.E. and Poulsen, K.H.

1986: Carbonatization of a metamorphosed layered mafic intrusion, San Antonio Mine, Bissett.

Bleeker, W.

1986: Deformational history of the Thompson orebodies.

Galley, A.G. and Franklin, J.M.

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Gordon, T.M., Hunt, P.A., Loveridge, W.D., Bailes, A.H. and Syme, E.C.

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Jackson, S.E.

1986: Metamorphic studies in the transition zone between the Lynn Lake greenstone belt and the Kiseynew gneiss belt, Laurie Lake.

Kaszycki, C.A. and DiLabio, R.N.W.

1986: Ultramafic dispersal train, Osik Lake.

Schmitt, R. and Friske, P.W.B.

1986: Trace element and gold anomalies, in regional lake sediment and water survey of 63K.

Skirrow, R.

1986: Deep footwall alteration zones beneath the Chisel Lake massive sulphide deposit, Snow Lake.

Williamson, B.L., Schwann, P.L., Scoates, R.J.S., Scoates, R.F.J., Duke, J.M. and Eckstrand, O.R.

1986: The Bird River Sill Project-Geology of the Chromitiferous Zones, eastern Chrome property.

Zaleski, E.

1986: The Linda deposit hydrothermal system, Snow Lake.

c) Prospectors and Developers Association, March 9-11, Toronto

DiLabio, R.N.W.

Placer gold at Manigotagan, Manitoba

d) Outside Meetings and field trips

Duke, J.M., Scoates, R.F.J., and Williamson, B.L.

Layer disruption in the Ultramafic Series of the Bird River Sill.
GAC/MAC '86, Ottawa, Ontario, May 1986.

Feuten, F.:

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Galley, A.G.:

Field trip of gold occurrences in the Snow Lake area for geologists of Boliden Minerals (Sweden) and HBED.

Gordon, T.M.:

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Hulbert, L.:

Platinum group element environments in the Churchill Province of northern Saskatchewan and Manitoba; Western Exploration and Geology Roundup, Victoria, B.C.

Jackson, S.L.:

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Petrochemical variations in a successive sequence of cyclic units, Upper Central Layered Zone (UCLZ), Fox River Sill, Manitoba. GAC/MAC '86, Ottawa, Ontario, May 1986.

Mandziuk, W.S., Brisbin, W.C., and Scoates, R.F.J.

The internal fabric of the Flacon Lake Igneous Complex, Southeastern Manitoba. GAC/MAC '86, Ottawa, Ontario, May 1986.

Skirrow, R.:

Field trip with A.H. Bailes through the alteration ends south of the Chisel Mines for geologists of the Manitoba GSB, GSC, and HBED.

Scoates, R.F.J.

Visiting Speakers Lecture, Queen's University, Feb. 3, 1986, Platinum-Group Elements and chromite mineralization in the Fox River Sill and Bird River Sill, Manitoba.

Scoates, R.F.J.

Seminar "Exploration in the Precambrian" organized by Utah Mines Limited, Toronto, March 6, Platinum-Group Elements in layered ultramafic complexes.

Scoates, R.F.J.

Cambridge University graduate students, Isle of Rhum, Inner Hebrides, April 21, 1986, Layer disruption, PGE mineralization and the role of supercooling in the crystallization of the Bird River Sill, Manitoba.

Scoates, R.F.J.

Contrasting modes of Platinum-Group element mineralization in two Manitoba layered intrusions - R.F.J. Scoates and O.R. Eckstrand; CIM District 6 Annual Meeting, Victoria, B.C., Oct. 4, 1986.

V: 1987-88 WORKPLAN

The Workplan for Sector A Geoscientific Activities during for 1987/88 was approved by MDA Management Committee in Ottawa (March 3, 1987) and copies distributed to members of the Mineral Exploration Liaison Committee on March 10. An outline of the intended programming will be provided in each of the mining districts, and in Winnipeg, prior to the field season.

In 1987, although most projects represent a continuation of work initiated in earlier years, several new projects will be introduced as outgrowths of recommendations from industry. Where possible other projects have been modified to respond to comments/requests from exploration personnel.

Forty-six (46) Provincial and twenty-two (22) Federal projects will be mounted with operational budgets of \$791,000 and \$1,521,000, respectively, 23% of the combined expenditures will be Lynn Lake directed, 37% toward the Flin Flon-Snow Lake region. The remaining 40% of programming is evenly divided between Southeast Manitoba, the Churchill-Superior Boundary, the Gods and Island Lakes regions, and Winnipeg-based compilations.

Fiscal constraints as well as a planned switch in emphasis from field surveys to office compilation, will result in a reduction of student hiring by the Province from forty-six (46) in 1986 to twenty-five (25) in 1987.

Applied Geoscience Research (AGR) agreements between the Province and University of Manitoba will be reduced from six (6) to five (5) with 1987 funding at \$76,000 compared to \$104,000 in 1986. To a certain extent this will be cushioned by GSC AGR agreements with the University which will entail five projects and \$60K in 1987 as opposed to six projects and \$50K in 1986.

Information releases and other outputs (ad hoc and annual) will continue throughout the year.

LYNN LAKE-RUTTAN

Manitoba Geological Services Branch (MGSB)

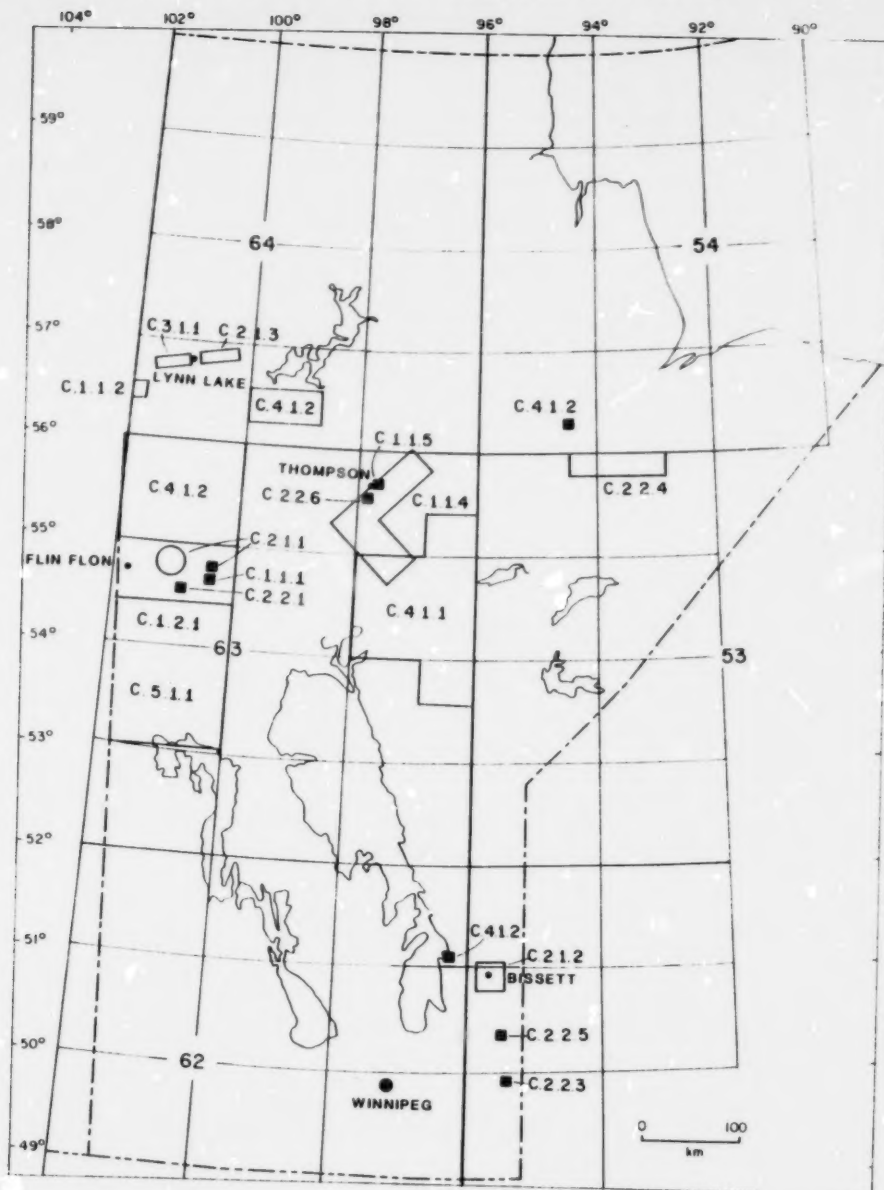
Geological surveys and mineral investigations have been conducted in the Lynn Lake-Ruttan region to establish key geological factors controlling mineralization, as well as to produce guidelines for mineral exploration activities aimed at discovering new base and precious metal ore deposits. Provincial and Federal surveys (that have generated numerous improved geological base maps, as well as airborne geophysical and geochemical data for this region) are now in an advanced stage of development and analysis, prior to release as technical publications.

Extensive discussions with exploration personnel in the Lynn Lake region have resulted in several changes and expansions to the intended range of MDA activities.

TABLE 3. GEOSCIENCE EXPENDITURE SUMMARY - 1987-88 FEDERAL AND PROVINCIAL (MANITOBA)

District Program	LYNN LAKE-RUTTAN		ELIIN FIION-SNOW LAKE		S.E. MANITOBA		Thompson		NORTHERN SUPERIOR		MANITOBA		TOTAL
	Canada	Manitoba	Canada	Manitoba	Canada	Manitoba	Canada	Manitoba	Canada	Manitoba	Canada	Manitoba	
1 Precambrian	12.0	4.0	184.5	160.4	-	4.0	55.0	61.5	-	3.0	-	-	232.9
2 Mineral Invest.	12.0	104.5	25.0	132.5	83.0	95.2	31.0	50.0	8.0	-	-	-	382.2
3 Geophysical	210.0	-	241.0	-	99.0	-	-	-	-	-	-	-	550.0
4 Geochem/ Glacial	148.0	30.0	32.0	-	-	-	10.0	-	209.0	-	-	-	411.0
5 Compilation/ Information	-	25.0	50.0	8.0	-	5.0	-	5.0	50.0	3.7	-	100.0	146.7
6 Coordination/ Overhead	9.9	-	9.9	-	9.9	-	9.9	-	9.9	-	-	-	49.5
Capital*	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS	391.9	163.5	542.4	300.9	203.9	104.2	105.9	116.5	276.9	6.7	-	100.0	1521.0
% OF TOTAL	26	21	36	38	13	13	7	15	18	1	-	12	100

FEDERAL SECTOR A PROJECTS: 1987/88



Lithosphere & Precambrian Studies

- C1.1.1 Mineralized Alteration Zones
- C1.1.2 Metamorphism in the Lynn Lake-Laurie Lake Area
- C1.1.3 U/Pb Geochronology, Churchill Province
- C1.1.4 U/Pb Geochronology, N.W. Superior Province
- C1.1.5 Structural Studies, Thompson Belt
- C1.2.1 Subpaleozoic Compilation/Core Drilling

Mineral Resources Division - Mineral Deposits

- C2.1.1 Flin Flon-Snow Lake Metallogeny
- C2.1.2 Bissett Structural Studies
- C2.1.3 Agassiz Remote Sensing Research
- C2.2.1 Flin Flon-Snow Lake
- C2.2.2 Northern Churchill
- C2.2.3 Falcon Lake Stock

Mineral Resources Division - Mineral Deposits (cont'd)

- C2.2.4 Fox River Sill
- C2.2.5 Bird River Sill
- C2.2.6 Thompson Nickel Belt

Earth Physics Branch

- C3.1.1 Aeromagnetic Gradiometer INPOT Surveys

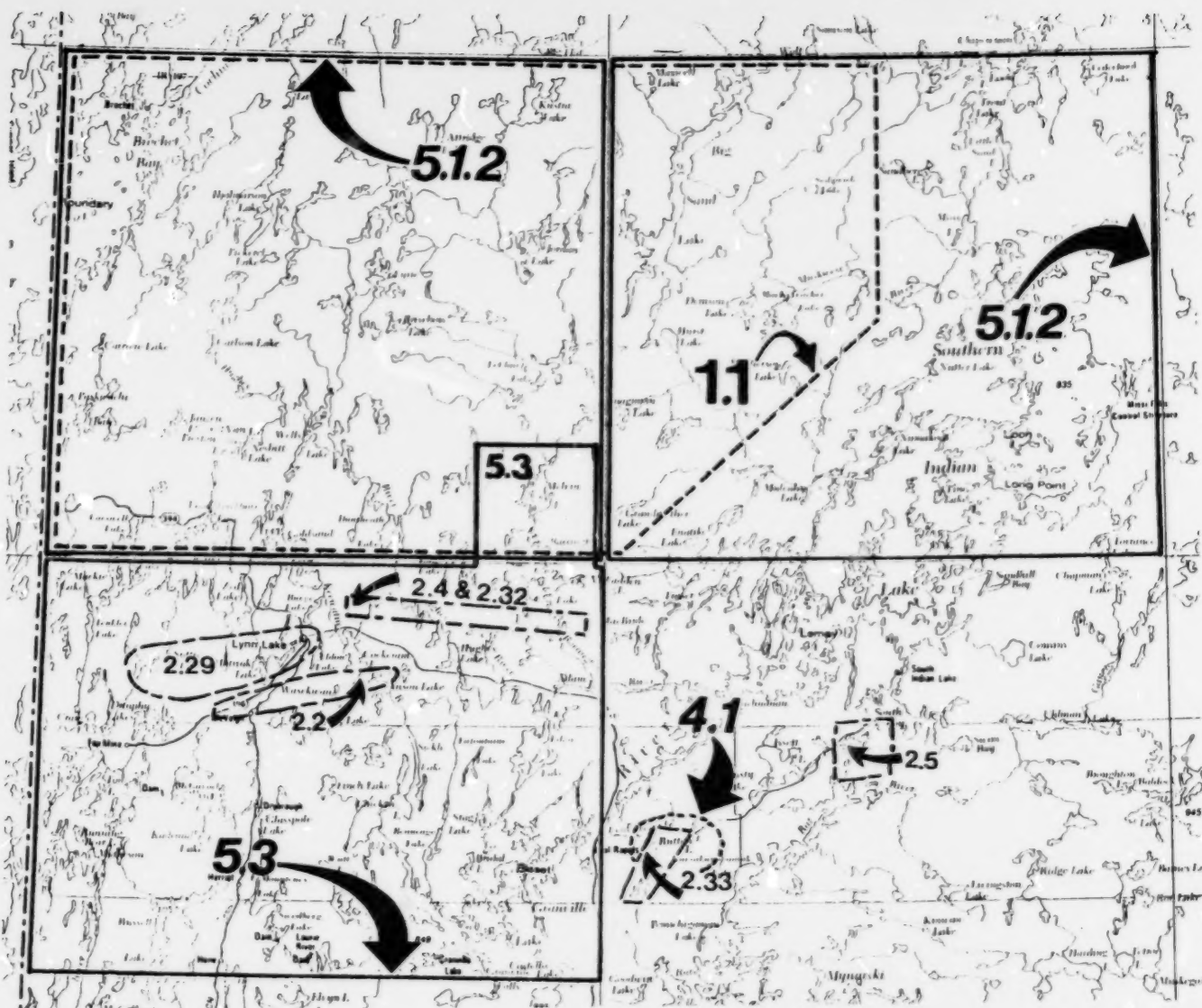
Mineral Resource Division - Exploration Geochemistry

- C4.1.1 Geochemical Surveys

Terrain Sciences

- C4.1.2 Glacial Prospecting
- C4.1.4 Quaternary Geochemistry
- C5.1.1 Quaternary Compilation

Figure 10: Federal Sector A projects (1987/88): All Districts



DISTRICT I LYNN LAKE - RUTTAN

- | | |
|---|--|
| 1.1 Geological mapping Brochet-Big Sand Lake (Report production) | 2.32 Iron Formation in Lynn Lake area |
| 2.2 Gold deposits, Johnson Shear | 2.33 Mineral Deposits, Ruttan area |
| 2.4 Geochemistry, biogeochemistry and stratigraphy of the Agassiz Metallotect | 4.1 Basal Till investigations, Ruttan |
| 2.5 Industrial Minerals evaluation | 5.1.2 Northern Churchill Synoptic geological compilation |
| 2.29 Mineral Deposit Geology, Lynn Lake area | 5.3 Lynn Lake reports and maps area |

Figure 11: Provincial Sector A projects (1987) - District I: Lynn Lake-Ruttan

Mineral investigations have proceeded from systematic regional documentation to in-depth studies of specific deposit types along the Johnson Shear Zone, the iron formation associated with the "Rainbow trend", and an extension of Agassiz-type rocks westwards towards Fox Mine area.

Glacial dispersion fans of ore minerals derived from buried mineralized zones have been used as indicators to locate concealed deposits in Precambrian bedrock. This year, work will extend earlier sampling down-ice of the Vol gold showing.

Synoptic compilations at 1:250 000 of the Brochet-Southern Indian Lake and Churchill River areas present large volumes of detailed geological data and interpretation, in a readily comprehensible format.

Geological Survey of Canada (GSC)

GSC will contract out a \$205K airborne electromagnetic INPUT survey of the MacMillan Lake area (west of Lynn Lake) to explore for possible extensions to the Agassiz gold-bearing units hosting the MacLellan and Farley deposits.

Basal till sampling in the Rusty Lake area and down-ice from the Darrol Lake occurrence will be used to explore for indications of additional gold deposits in the Ruttan area.

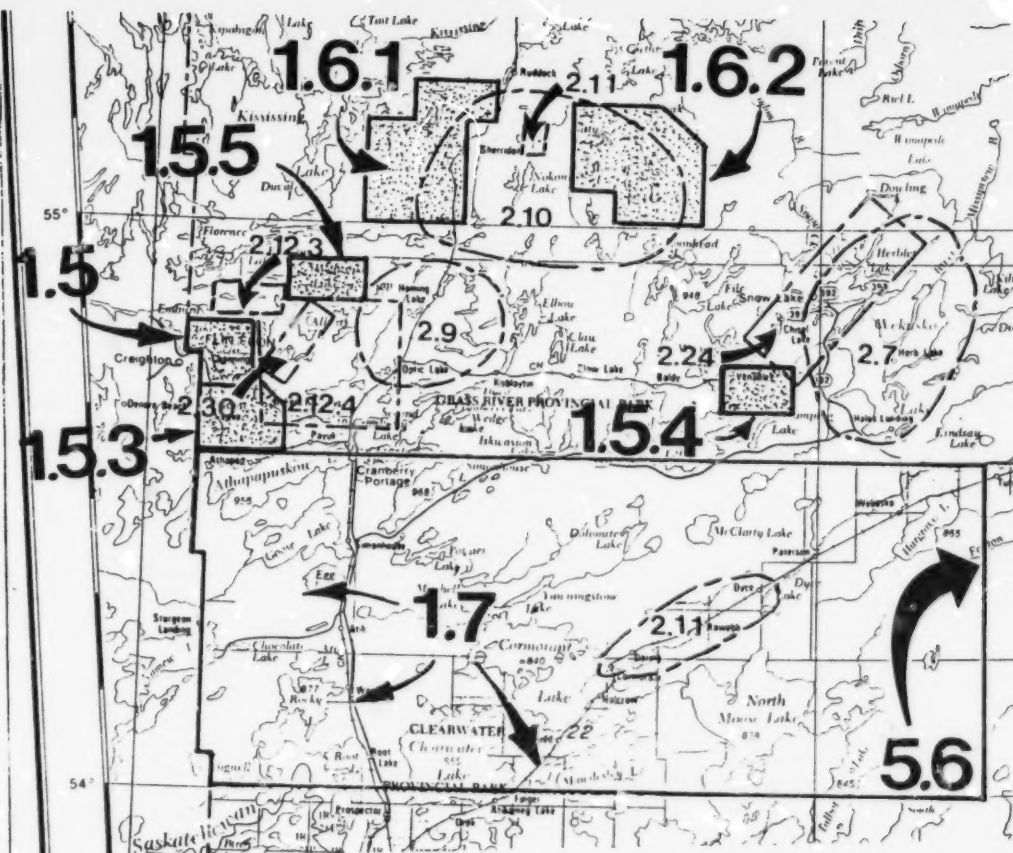
Metamorphic, and lead isotope studies undertaken to determine the history of crustal evolution in the Lynn Lake region will be completed as an integral part of the process to reconstruct the original configuration and tectonic and metallogenic setting of these greenstone belts.

FLIN FLON - SNOW LAKE

MGSB

During the MDA, the Provincial Geological Services Branch and Federal Geological Survey have mounted numerous mapping programs and other technically specialized minerals investigations aimed at documenting the geological setting of known mineralization, and determining the structural, chemical and genetic controls that resulted in the formation of the copper- and zinc-bearing orebodies that are now being rapidly depleted. Increased emphasis is also being given to the greenstone belts' potential to contain significant gold deposits that may have been overlooked in previous massive-sulphide-focussed exploration campaigns.

Detailed 1:20 000 geological mapping in the Flin Flon area has been completed and mapping in Athapapuskow, Chisel and Tartan Lakes areas will be continued in parallel with regional and 1:50 000 mapping to evaluate potential gold and tungsten metallotects in the Kississing-Batty-Limestone Point Lakes area.



DISTRICT II FLIN FLON - SNOW LAKE

- 1.5 1:20 000 mapping Flin Flon, etc.
- 1.5.3 1:20 000 mapping Athapapuskow Lake
- 1.5.4 1:20 000 mapping Chisel-Morgan Lakes
- 1.5.5 Tartan Lake geological mapping
- 1.6.1 1:20 000 Kississing Lake mapping
- 1.6.2 1:20 000 Batty Lake mapping
- 1.7 Scout drilling, Project Cormorant
- 2.7 Gold deposits Snow Lake area
- 2.9 Deposit documentation Flin Flon
- 2.10 Deposit documentation Sheridan
- 2.11 Industrial minerals evaluation
- 2.12.3 Tartan Lake Geochemistry
- 2.12.4 Metallogeny of Felsic Intrusion rocks, Flin Flon
- 2.24 Copper-Zinc deposits, Snow Lake area
- 2.30 Mineral deposit geology, Flin Flon area
- 5.6 Subproterozoic compilation

Figure 12: Provincial Sector A projects (1987) - District II: Flin Flon-Snow Lake

From Athapapuskow Lake to Hargrave Lake total field and vertical gradient magnetic surveys and scout drilling have been used to develop maps of the buried Precambrian Shield that industry can use to trace mineralized formations beneath the limestone cover-rocks south to latitude 54°. Scout drilling of selected magnetic anomalies will continue, as will petrographic studies of the drill core.

In this region and the Lynn Lake district the industrial mineral resources will be evaluated to explore the potential for new industries based on abrasives, refractories, building stone, soapstone, and other industrial minerals.

GSC

Massive sulphide associated alteration zones at Wolverton, Cook Lakes and at the Linda deposit will be investigated further, as will cordierite-garnet-anthophyllite units in the Sherridon area. Scout drilling of remotely situated anomalies in the Project Cormorant area, may be required pending evaluation of results from the eight holes drilled during the 1986/87 program.

Gold deposit field studies will be completed in the Snow Lake area, whereas kinematic studies of faults related to gold mineralization will be completed in the Herb Lake area. Open Files on Snow Lake and Elbow Lake will be completed in the late fall of 1987.

Samples selected from mafic/ultramafic complexes will be analyzed to evaluate PGE abundances specifically for the Reed Lake, Jackfish Lake and Chisel Lake intrusive complexes.

Follow-up till sampling in the Kississing Lake map sheet (63N) in areas of anomalous till geochemistry will be augmented by airphoto interpretation of the surficial geology in NTS areas 63-0 and 63N, with resultant Open File releases.

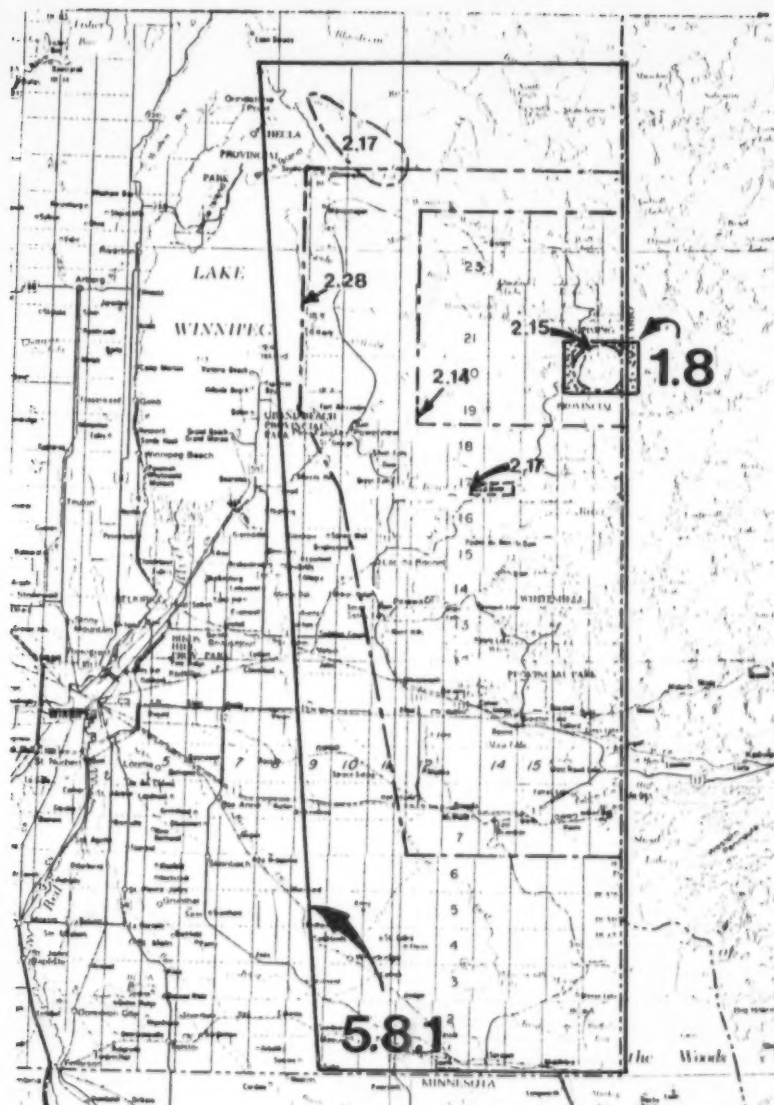
One month of field work in The Pas area will ground-truth airphoto interpretation of surficial geology for NTS areas 63C, F and K.

SOUTHEAST MANITOBA

MGSB

Geological mapping and mineral programming in the Bissett region will continue to focus on the long established gold potential of the belt with specific emphasis on new environments for gold deposition. Known deposits are being studied and documented in detail but an important emphasis will be placed on geological work in up-to-now unexplored, potentially new environments for gold (and base metal) deposits, such as stratabound mineralization. Programs will be directed toward intensive sampling and geochemical assays of specific deposit types in the Wallace Lake, Stormy Lake and Gem Lake areas.

In the Bird River region, the initial evaluation of platinum group elements and chromite will be extended to encompass detailed geological mapping and sampling of ultramafic rocks, other than the Bird River Complex.



DISTRICT III SOUTHEAST MANITOBA

- 1.8 Rice Lake geological mapping
- 2.14 Deposit documentation Rice Lake area
- 2.15 Mineral Deposit Studies, Rice Lake
- 2.17 Platinum element evaluation
- 2.28 Dimension stone resource assessment
- 5.8.1 Geological compilation

Figure 13: Provincial Sector A projects (1987) - District III: Southeast Manitoba

A dimension stone resource evaluation program will be extended to encompass granitic rocks in the Rice Lake area and non-granitic rocks throughout the Precambrian of southeast Manitoba.

GSC

1:50 000 mapping of the San Antonio Mine sequence, and 1:10 000 mapping of the area south and east of Rice Lake will be undertaken, as well as structural mapping along the Wanipigow fault, and selected gold occurrences throughout the Rice Lake-Beresford Lake region. Sundry studies of structure, alteration and stratigraphy of the San Antonio Mine will also be implemented.

Petrochemistry of the Falcon Lake Stock will be investigated by N. Halden (U. of M.) and detailed mapping and sampling of chromitite seams in Bird River Sill will be continued in conjunction with other MDA Sectoral activities.

Gold-bearing Lake Agassiz beach sands at Manigotagan will be systematically sampled with a backhoe.

THOMPSON

MGSEB

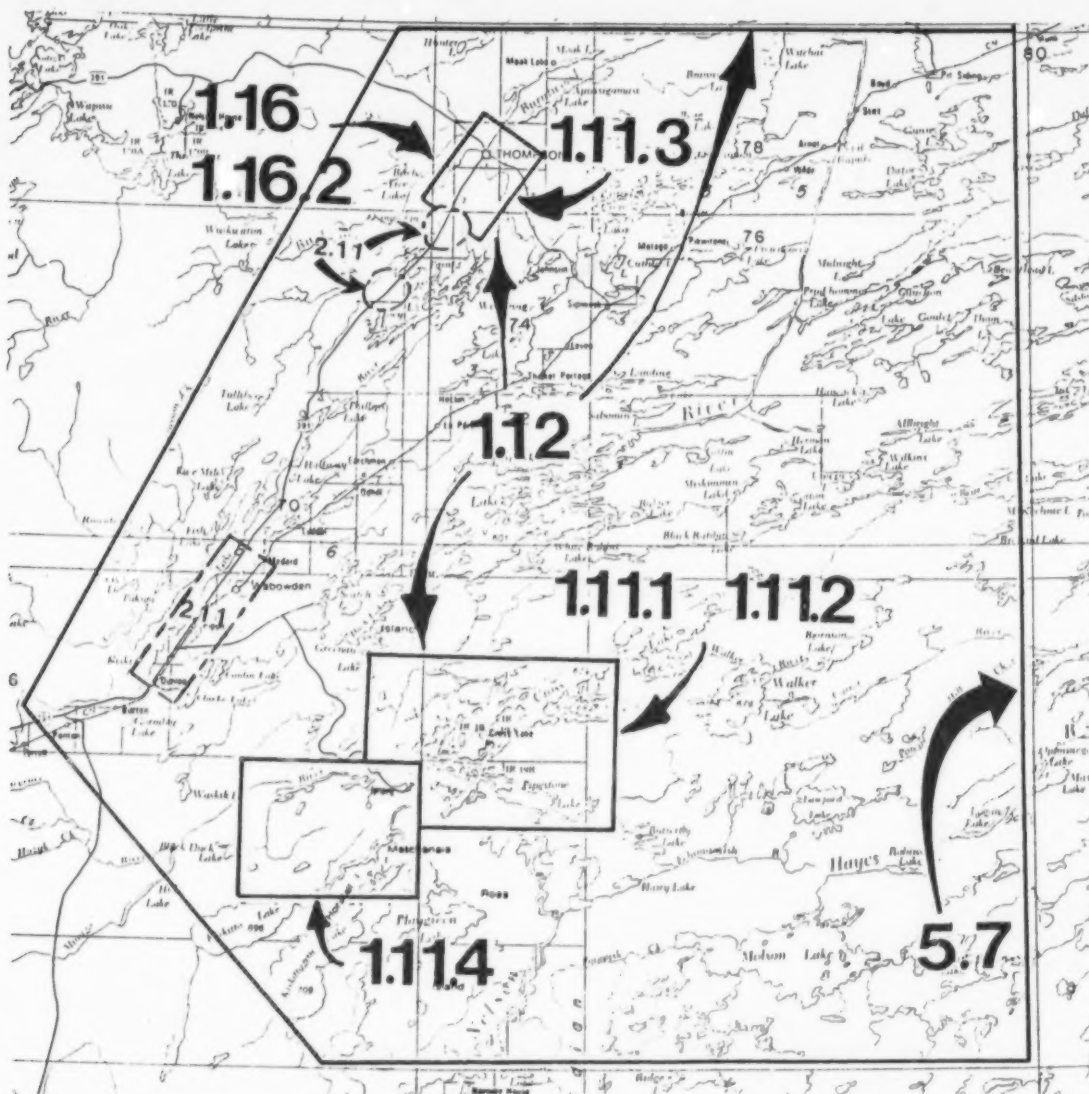
Much of the work in this region is evaluating the potential for diversifying the existing nickel-dependent mineral base. Projects focus primarily on known occurrences of iron, vanadium and titanium, and an evaluation of potential gold and platinum metallotects both in the Cross Lake greenstone, and gneissic Pikwitonei terrain. The Nelson River anorthosites are being investigated for building stone potential and/or economically significant titanium, chromium and platinum concentrations. A geological compilation program at 1:250 000 scale will synthesize the regional aspects of the Churchill-Superior boundary zone itself.

The Department of Geological Sciences, University of Manitoba will provide additional Rb/Sr isotope analyses from three rock units from Cross Lake, and four from the Thompson-Split Lake area. Analyses will also be undertaken of mafic-ultramafic rocks in the Thompson and Pipe open pits, as well as Oswagan and Assean Lakes areas.

In this the fourth year of the Agreement the University of Manitoba study of rare-element-enriched pegmatites will continue analysis of samples from Magill Lake, Red Sucker Lake and other pegmatite fields in the northern Superior Province.

GSC

Uranium/lead dating of samples from Pipe Pit, Thompson Pit and Cross Lake belt will continue, as will a structural study covering a transect from the Superior Province across the Pikwitonei and Thompson belt into the Churchill Province. 1:20 000 mapping in and around the Thompson Pit will be completed. All exposures in the area surrounding Thompson Ore structure and the other nickel sulphide deposits in the belt will be examined, and underground mapping will also be undertaken where necessary to complete characterization of the Thompson Ore structure.



DISTRICT IV THOMPSON

- 1.11.1 Cross-Pipestone Lake mapping
- 1.11.2 Titanium-vanadium evaluation (report production)
- 1.11.3 Thompson Pit mapping
- 1.11.4 Nelson River anorthosite evaluation
- 1.12 Uranium/Lead geochronological sampling
- 1.16 Rubidium-strontium isotope investigations
- 1.16.2 Thompson geochemistry
- 2.20 Rare-element enriched pegmatite evaluation
- 5.7 Thompson-Pikwitonei compilation

Figure 14: Provincial Sector A projects (1987) - District IV: Thompson

NORTHERN SUPERIOR

MGSB

MDA activities in this region have been growing in importance as industry has expanded its exploration programs to test the perceived high residual gold potential of the Gods, Island, and Oxford Lakes region. Both Island Lake and Gods Lake have historically been gold producers, and new finds of gold mineralization could result in the development of self-contained mining, milling and smelting operations in these relatively remote and inaccessible sectors of the Province. As of March 1987 Bighorn Development is particularly optimistic about its property on Ministik Island, and several companies have initiated exploration programs in neighbouring greenstone belts (e.g., Stull, Kistigan and Bigstone Lakes).

Geological Services Branch programs will continue evaluation of the geological mapping of Island-Bigstone-Knight-Stevenson-Ponask Lakes and continue compilation of geological data of northern Superior Province for publication in the Atlas series.

Rare-element pegmatites on Red Sucker Lake will be further investigated in view of their extreme degree of fractionation, large geochemical anomaly, and potential to contain significant amounts of cesium, lithium and tantalum minerals.

GSC

GSC regional lake sediment surveys will be extended to include coverage for NTS areas 63-I, 63H (NE 1/4) and 63P (SE 1/4) with increased sample density over the greenstone belts. Four drill holes remain to be logged from BP-Selco's 1986 exploration program and further work and drill core examination is anticipated.

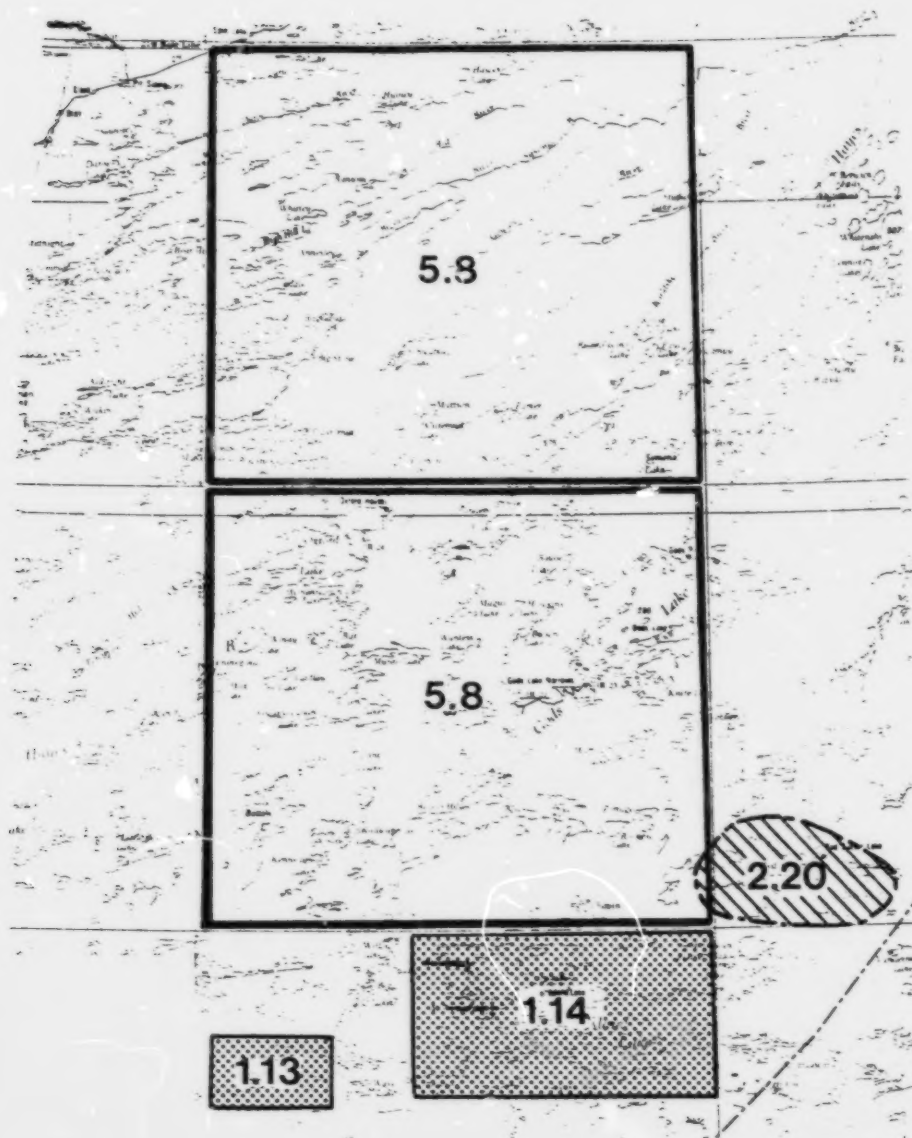
WINNIPEG-BISED

MGSB

In this the fourth year of the Agreement greater emphasis is being placed on data compilation analysis and report writing. Work will continue on the development of the synoptic geological atlas of the Province with 1:250 000 compilations being prepared for NTS areas 52E and L, 53L, 54E (W 1/2), 62H, 63-0 and N, and 64F, G and H.

1:50 000 Mineral Deposit maps will be compiled for various sectors of the Lynn Lake, Flin Flon and southeast Manitoba districts, and the Bibliography of Manitoba Geology will be upgraded to include keyword references and selected retrievals by area, author, and other parameters.

Mineral Inventory cards will be updated and several brochures and displays will be produced highlighting various aspects of Manitoba's mineral industry and MDA activities.



DISTRICT V NORTHERN SUPERIOR

- | | |
|------------|---|
| 1.14, 1.13 | Island Lake geological mapping |
| 2.20 | Rare-element enriched pegmatite evaluation |
| 5.8 | 1:250 000 synoptic geological compilation,
Gods Lake |

Figure 15: Provincial Sector A projects (1987) - District V: Northern Superior

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